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LOCAL ANESTHESIA AN ADJUVANT IN OCULAR THERAPEUTICS: IS THE PROCESS OF ABSORPTION UNDER NERVE CONTROL?

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MONTE CARLO, FRANCE.

The hypothesis is offered that the corneal nerves exert an inhibitory influence on absorption, and that the latter is favored by paralyzing these nerves. Experiments which seem to sustain the hypothesis. Adrenalin as a mydriatic. Practical applications of the theory.

This paper is intended to suggest a field of investigation, the development of which appears to promise results of practical value and possibly also of theoretic significance.

In a report of cataract operations, read at the 1891 meeting of the American Ophthalmological Society[1], I alluded to a case of ulcer of the cornea, in which not only was the usual treatment without effect on the ulcer, but the free instillation of a solution of atropin gr. iv. to 3i did not produce the slightest change in the size of the pupil altho the iris tissue was clearly normal. In that case the application to the ulcer of two or three drops of the mydriatic solution heated almost to the boiling point was followed by prompt dilatation of the pupil and rapid cure of the ulcer.[2]

CASE 2. On June 5th, 1921, Raymonde D. of Monte Carlo was brought to me suffering with lacrimation, photophobia and pain in the right eye. The trouble had lasted about three weeks. No history of traumatism. Examination revealed an ulcer of the cornea two mm. in diameter and situated on the 10 o'clock meridian, midway between the center and the margin. The pupil, like its fellow, was three mm. in diameter. Iris tissue healthy.

The treatment ordered was as follows:—A 1% solution of atropin to be instilled three times a day. Solution of cyanid of mercury 1 to 5,000 to be used every two hours. White's bichlorid ointment morning and evening. Hot compresses and pressure bandages. General tonic treatment under direction of the family physician.

This regime was faithfully carried out for a week with negative results, the ulcer showing no appreciable change and the pupil remaining persistently at about 3 mm., altho, in addition to the atropin used by the mother, I myself applied the solution copiously at each visit.

On June 12th the child, as she entered my room, was the embodiment of woe. She walked in slowly, head bent and tears flowing down her cheeks. She had passed a sleepless night from pain. I proposed applying the treatment which had been so successful in the case referred to above. But, as the little one was extremely sensitive, her mother begged me to try something not so severe. After a little reflection, as I was convinced that the rigidity of the pupil in this and in the preceding case was in some way connected with the irritation of the nerve filaments in the ulcer, and that the dilatation of the pupil in the first case was due to the obtunding of the sensibility of these nerves by the very hot solution used, I offered to try milder means for twenty-four hours stipulating that, in case of nonimprovement, I should insist on resorting to the more radical measure. Accordingly I instilled two or three drops of a 4% solution of cocain, followed, five minutes later, by atropin. The treatment previously instituted was to be continued.

The next day the child seemed transformed. She danced gaily into my room head well up and eyes wide open, all the symptoms greatly ameliorated and *the pupil widely dilated.* As a matter of precaution I made one more application of the cocain. On June 15th the case was proceeding so well that the mother thought she could manage it herself. On June 24th I saw the child again and found the ulcer completely healed. Ten months later, in April, 1922, the scar had almost disappeared and the vision was normal. As a matter of experiment I applied a weak solution of atropin which dilated the pupil normally.

In the two cases described above, it is difficult to explain the failure of the pupil to respond to the mydriatic before the special treatment applied in each case. It is unthinkable that the atropin was completely washed away by the abundant lacrimation. The tears could dilute, but they could not eliminate, the mydriatic, and even the dilution was perhaps not so considerable as might be imagined because, in applying the atropin, I kept the eye almost dry by the capillary action of a bit of cotton held against the outer canthus while I let the atropin fall drop by drop upon the globe.

In the cases described by Morax[3] as "Ulcères de la Cornée Sphinctéralgiques," there is a reflex miosis which is very imperfectly overcome by the atropin, but the latter is never without some effect. In the cases here reported there was properly speaking no miosis at any time, and there was no mydriasis after the application of the atropin. It would seem as if absorption in so far as atropin was concerned was suspended. Could this have been due to an irritative reflex influence starting in the sensitive nerve filaments in the ulcer? In other words, is it possible to conceive of absorption as not being entirely a mechanical process but as to some extent under the domination of the nervous system? Are there grounds for the hypothesis that *the corneal nerves stand guard over absorption, and that the latter is favored by putting the sentinels to sleep?* It is conceivable that the rapid dilatation of the pupil in the two cases recorded in this paper might be explained by changes in the corneal epithelium caused in the first case by the hot water, and in the second by the cocain, but the antecedent obstinacy of the pupils would remain to be accounted for.

The hypothesis suggested, if confirmed, would explain both phenomena —the latter by an inhibitory reflex obstruction to the absorption of the atropin, and the former by the overcoming of this reflex thru abolishing the sensibility of the corneal nerves by means of the agent employed in each case.

With a view of testing this question, I have made a considerable number of experiments in which I used a mydriatic in both eyes, preceded by the instillation of a nonmydriatic anesthetic in one of them. I did not note the effect on the accommodation because I was concerned, for the moment, only with the question of absorption, and the behavior of the pupils would constitute an adequate test.

I report only a few of these experiments because they are typical.

(1) Butyn 2% and homatropin, 4%—
J.S. 11 Male—
Pupils 3 mm. in diam.
1.15 Butyn O.D.
1.20 Homatropin both eyes.
1.40 Pupil O.D. 6mm. O.S. 5 mm.
1.50 Pupil O.D. 8 mm. O.S. 7 mm.

(2) Allocain (French novocain) and homatropin—
P.N. 7. Male—
Pupils 3 mm.
1.40 Allocain O.D.
1.50 Allocain O.D.
1.55 Homatropin both eyes.
2.20 Pupil O.D. 7 mm. O.S. 6 mm.
2.30 Pupil O.D. 8 mm. O.S. 7 mm.

(3) Allocain and homatropin—
R.S. 12. Female—
Both pupils 3 mm.
2.00 Allocain O.D.
2.08 Homatropin both eyes.
2.40 Pupil O.D. 4 mm. O.S. 3 mm.

(4) Butyn and Homatropin—
J. C. 12. Male—
Both pupils 4 mm.
2.30 Butyn O.D.

2.35 Homatropin both eyes.
2.55 Pupil O.D. 6 mm. O.S. 5 mm.
3.10 Pupil O.D. 8 mm. O.S. 7 mm.

Later I was able to procure holocain which in 4% solution seemed to be about equal to butyn 2%.

(5) Holocain 4% and atropin 0.2%—
Miss G. 21—
Pupils 3 mm. in diam.
1.42 Holocain O.D.
1.45 Holocain O.D.
1.52 Atropin both eyes.
2.20 Pupil O.D. 9 mm. O.S. 7mm.

The influence of the anesthetic—what I may call the *anesthesia increment*—as shown by the degree of dilatation of the pupil varies with the anesthetic employed, but all of the experiments showed increased absorption from their use and hence were confirmatory of the hypothesis under discussion. I have observed that allocain was not so effective as either butyn or holocain, probably because the former does not penetrate the corneal tissue so energetically as the latter two.

As adrenalin has been observed in some rare cases to dilate the pupil, whereas, ordinarily, it has no such effect, it occurred to me that it might be useful in testing the hypothesis of nerve influence on absorption. Accordingly I made many experiments with this drug, of which I report only the following as the results were uniform:—

(1) Butyn 2% and adrenalin 1 to 3,000—
Mrs. L. 60—
Both pupils 2 mm.
2.12 Butyn O.D.
2.15 Butyn O.D.
2.18 Adrenalin both eyes.
2.40 Pupil O.D. 4 mm. O.S. 2 mm.
3.00 Pupil O.D. 7 mm. O.S. 2 mm.

(2) Butyn and adrenalin—
Miss R. 79—
Pupils both eyes 2 mm.
9.00 Butyn O.D.
9.05 Butyn O.D.
9.10 Adrenalin both eyes.
9.40 Pupil O.D. 3 mm. O.S. 2 mm.
10.00 Pupil O.D. 7 mm. O.S. 2 mm.

(3) Allocain and adrenalin—
Mrs. P. 60—
Pupils both 3 mm.
2.30 Allocain O.D.
2.55 Allocain O.D.
Adrenalin—See mst.
3.30 Pupil O.D. slightly larger than O.S.
3.50 Pupil O.D. 4 mm. O.S. 3mm.

(4) Holocain and adrenalin—
Madame F. 48—
Both pupils 3 mm.
4.32 Holocain O.D.
4.37 Holocain O.D.
4.43 O.D. flushed with sterilized water.
4.44 Adrenalin both eyes.
5.10 Pupil O.D. 5 mm. O.S. 3 mm.
5.15 Pupil O.D. 6 mm. O.S. 3 mm.

(5) Holocain and adrenalin—
Miss C. 66—
Both pupils 2 mm.
1.55 Holocain O.D.
2.00 Holocain O.D.
2.04 Holocain O.D.
2.10 O.D. flushed with water.
2.11 Adrenalin both eyes.
2.35 Pupil O.D. 7 mm. O.S. 2 mm.

The washing out of the conjunctival sac in two of the foregoing cases might well seem like "painting the lily" and so indeed it proved. I merely desired to exclude the remote possibility of the formation, in the sac, of a new chemical compound with mydriatic properties.

The results of the experiments effectually settle the status of adrenalin as a mydriatic, in which respect it is shown to be exceedingly efficient *when it has a chance* i.e., when it can penetrate the corneal tissue owing to the previous suppression, by means of a local anesthetic, of the barrage presented by the corneal inhibitory nerves. I have no doubt that it would be equally or even more effective if injected into the anterior chamber.

An interesting fact which I observed was the rapid drying up of the anesthetized eye as compared with the other after the application of the adrenalin. The former greedily drank up the solution as a sandy soil does water. Moreover the blanching was much more marked on this side.

The experiments with adrenalin were well under way when I saw Dr. Knapp's paper read at the 1921 meet-

ing of the Amer. Ophthal. Soc., in which he showed that this remedy frequently dilates the pupil in glaucoma. In the light of the knowledge furnished by my experiments, it would be natural to expect this result on account of the corneal anesthesia which is such an important feature of the malady. Knapp states that in some of the cases in which the disease was confined to one eye, the other (normal) eye showed pupillary dilatation after the use of adrenalin. Possibly in such cases careful testing would reveal some defect of corneal sensibility as an advance symptom, and would thus emphasize the value of Knapp's noteworthy contribution to the diagnosis of glaucoma.

Loewi (quoted by Fuchs[4]) has seen adrenalin mydriasis in diabetic patients. I have recently examined a man who has had sugar in the urine for many years. In the left eye is a ripe cataract. The projection is perfect and the pupil normally responsive to light. Testing the sensibility of the cornea, I found it very slightly diminished, but not sufficiently to facilitate the absorption of adrenalin, the pupil remaining unchanged. It is possible that more decided anesthesia of the cornea may sometimes be found in this disease, in which case adrenalin mydriasis might be looked for.

The adrenalin mydriasis, found by Loewi[5] in Graves' disease, and by Weekers[6] in paralysis of the ocular sympathetic, presents a rather more complicated problem involving the innervation of the iris, and would require a more extended consideration than the limits of this paper allow of; but I may be permitted to remark that in every case in which adrenalin dilates the pupil the corneal sensibility ought to be tested.

It has long been known that the addition of cocain to homatropin intensifies the effect of the latter as e.g., in employing Wood's useful tablets. In common with many others, I have for many years suspected that cocain increased the action of atropin. This suspicion has been recently demonstrated to be correct by Inasburo Naito[7], who has furthermore shown that the effect of the combination of atropin and cocain is greater than the sum of the effects of each of them. He simply notes the fact without attempting to account for, it but the explanation is not difficult. The unknown factor, the tedium quid, is obviously the *anesthesia increment,* i.e., the increased absorption of the atropin resulting from the anesthesia induced by the cocain.

If the theory, the correctness of which I have been endeavoring to substantiate, can be seriously considered, two questions present themselves:—1st, what is the precise mechanism—the reflex arc—concerned in the rôle played by the nervous system in absorption? And, 2nd, is the sphere of this influence confined to the eye?

The first question may for the present be left unanswered, but to the second a few words may be devoted. Weekers[8] says that the intravenous injection of extract of suprarenal capsule produces mydriasis. My opportunities for consulting the literature being at this time limited, I do not know whether any account has been published of the effect on the pupil of injection of this substance into the subcutaneous tissue. If such injections should show a decidedly less mydriatic effect than those made intravenously, and if, moreover, a preliminary injection of a non-mydriatic anesthetic should result in a more pronounced mydriasis by the subcutaneous route than was observed without the anesthetic, we might fairly conclude that, by the intravenous route, the fluid slips past the guardian nerves, whereas, by the other route, these nerves block the way. We might therefore reasonably entertain the idea that the theory of nerve influence in absorption is not strictly local in its application, but that it is to be regarded as a general physiologic principle.

SOME PRACTICAL APPLICATIONS OF THE THEORY

Taking advantage of the fact that the preliminary use of a local anesthetic converts adrenalin into an effective mydriatic, I have lately been employ-

ing this drug instead of cocain to dilate abnormally small pupils for ophthalmoscopic examination. I have seen no reason to regret this practice, but I apply pilocarpin afterwards as a precautionary measure. A solution containing holocain 4% with adrenalin 1:5000 answers the purpose, altho a more decided mydriasis is obtained by using the holocain first.

The two cases cited in this paper exemplify in a striking manner the paramount place that atropin occupies in the therapeutics of corneal ulcer. As long as evidence of absorption of the drug, judging from the behavior of the pupil, was negative, the ulcers remained *in statu quo;* whereas the moment such evidence was positive, the change for the better was magical. It seems probable that in all cases of ulcer of the cornea in which the speedy action of atropin is indicated, the healing process might be expedited by the application of a local anesthetic—preferably nonmydriatic—previously to instilling the atropin. The same practice would quite likely be useful in various forms of keratitis, and in iritis and other inflammatory conditions of the uveal tract.

After the preceding pages were written my friend Dr. Drualt of Tours, who had already furnished me with several useful references, called my attention to some remarks on the experience of T. Harrison Butler[9] in a case of chronic glaucoma, in which the instillation of cocain followed by eserin produced faintness and giddiness, while either remedy, by itself had no such effect. This case suggests the probability that the absorbability of miotics like that of mydriatics is increased by preliminary anesthesia of the cornea. If this is true, the case is interesting in that the anesthesia increment was sufficient in this instance to pass the limits of the patient's tolerance of eserin. In this case the corneal anesthesia may have been directly due to the cocain, or—if enough time had elapsed between the instillations for the anesthetic influence of the remedy to pass off—it may have been a true glaucomatous anesthesia occasioned by a temporary, cocain induced, aggravation of the disease. Experiments with pilocarpin and eserin, analogous to those previously described, will decide whether miotics act in this respect like mydriatics. Others may have better opportunities than I have at present for undertaking these experiments.

The question whether the absorption of liquids, other than mydriatic or miotic, can be facilitated by preliminary anesthesia of the cornea can perhaps be determined, definitely, only by delicate quantitative analyses of the aqueous humor, but I think it not unlikely that the absorbability of all absorbable liquids can be enhanced in the same manner. Hence, in cases of infection involving the anterior, and possibly also the deeper, portions of the globe, antiseptic solutions, like cyanid of mercury, might be made to penetrate the tissues more thoroly and effectively. Similarly in all the cases indicating the use of thiosinamin or fibrolysin, particularly opacities of the cornea in its deeper layers, the efficacy of these drugs might be considerably augmented. I am at present trying the effect of a local anesthetic applied a few minutes before eye baths of chlorid of lime, the iodides, etc., in the attempt to retard or prevent the development of cataract.

Other practical applications of the theory will readily suggest themselves. I have merely scratched the surface of a field which I am inclined to think will repay cultivation.

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VITREOUS MEMBRANES UPON THE IRIS WITH ADHERENT LEUCOMA OF THE CORNEA.

YOSHIHARU YOSHIDA, M.D.

KYOTO, JAPAN.

This is a report of the findings of histologic studies of iris removed in three cases, and of similar appearances observed clinically in eight others. These irides presented small pits, the floor of which was covered with a homogeneous membrane behaving like a vitreous formation upon the iris. Such membranes were sometimes covered with a single layer of flat pigment cells, but were generally bare. It is ascribed to the endothelium of the posterior surface of the cornea. Contributed from the University Eye Clinic of Kyoto in the service of Professor Ichikawa. Translated from the German by Dr. H. Aufmwasser.

The formation of a vitreous membrane upon the iris is no rare occurrence. The cases, which I will describe, are marked with peculiar clinical features and thru its frequent occurrence with adherent leucoma of the cornea. That no histologic examinations of the formation of vitreous membranes of this nature have been reported to date, has prompted me to publish these cases.

The right iris showed, besides general atrophy of the iris tissues, on its surface external and downward, numerous ditch like recesses of varying size and shape. They are easily distinguishable from the physiologic crypts of the iris by their peculiar yellowish-brown color and the smooth surface of the floor without the barge like figures. They mostly corresponded to the course of the frill of the iris

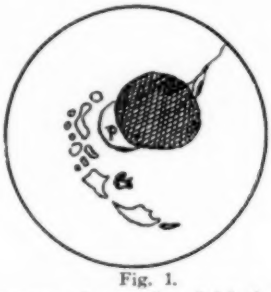

Fig. 1.

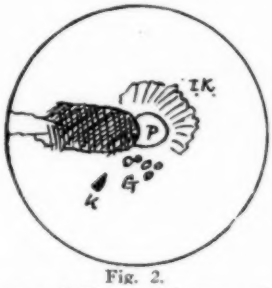

Fig. 2.

Case 1. Diagrams of corneal and iris lesions. Fig. 1, right eye, and Fig. 2, left eye. G. iris pits, P. pupil, K. crypt of iris, I.K. iris frill.

CASE 1. A woman aged 22 years. Six days after birth she suffered from a profuse discharge of pus from both eyes, resulting in dense white opacities of both corneas. She presented herself at our clinic Feb. 21, 1921. The conditions at the time were as follows: The palpebral and bulbar conjunctivas were normal. The scleras likewise. On both corneas there were opacities of about 3.5 mm., obliquely oval in outline and situated slightly inward from the center. The anterior chambers in both eyes were more shallow than normal. A peculiar change of the iris, which interested me especially, was apparent in both eyes, more so in the right eye than in the left.

and are in size from a millet seed to half a grain of rice. In shape they vary greatly, some are round, some oval and others are irregular squares; some are joined together by small grooves. Their borders are very sharply defined and the margins more or less distinctly undermined. An ophthalmoscopic view was not possible. (Diagram, Fig. 1.) The same changes were also noted on the iris of the left eye; they only vary from those of the right eye in degree. (See Fig. 2.) The pupil in this eye was illuminable, and no pathologic changes of the fundus were discernable. Both fields of vision were normal. Tension not high. V.R. = 1,5/F, V.L. = 1,5/F.

On Oct. 19, an optical iridectomy downward was performed. The piece of iris obtained was fixed in formalin, embedded in celloidin, and cut into sections vertical to the pupillary sphincter. A few sections were also examined after depigmentation.

Histology: At the site where the groove formation was clinically demonstrated, a flat depression was found on the upper surface of the iris. At the margin the same is more or less distinctly overhanging edge. The free surface of the membrane is generally bare, but often one observes here and there, in shape of islands, sometimes continuous, some cell granules, ranged in single rows, which at the margin are mostly in close connection with the surrounding iris tissue.

These cells were poor in protoplasm, and at the site corresponding to the nuclei, they were swollen, taking a spindle like shape and having in their

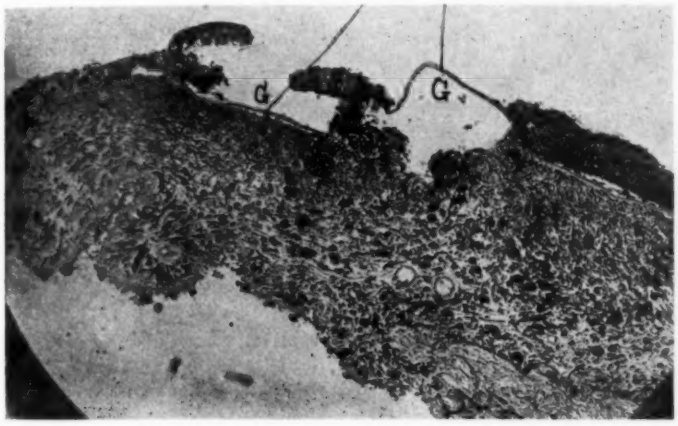

Fig. 3. Section of iris from Case 1 showing pits G G and vitreous membranes. Enlargement same as Fig. 4.

undermined, so that its floor was broader than its margin. The most apparent change that is observed here, is the formation of a homogeneous membrane on its floor. It is of about the thickness of Descemet's membrane, but differs from the same in that it shows in parts, toward its free upper surface, a small elevation. It thins out gradually toward the periphery and terminates sharply. The surface of the membrane adjacent to the iris tissue is entirely smooth. It lies smoothly upon the iris tissue without any firm connection.

Occasionally one encounters a detachment, which, however, is for the greater part artificial and but rarely occurs intra vitam. In the latter case there is observed, between the iris and the membrane, a thin granular mass, stainable faintly red with eosin. In a few sections where the undermining of the margin was especially deep, I have found that the membrane was also continued over the surface of the cell bodies a variable number of well stained pigment grains. The iris tissue adjacent to the membrane seemed to be richer in cells, more compact and richer in pigment than normal. Otherwise the iris is normal and no inflammatory cell infiltration was found anywhere. (Fig. 3).

CASE 2. A man 24 years of age. In the second year of his life he suffered from a severe inflammation of his left eye, leaving a leucoma of the cornea. Presented himself April 18, 1922. The conjunctiva and sclera of both sides were normal. The left cornea is normal, except for the presence of an adherent leucoma situated at about the center and a little downward, and was approximately 3 mm. in size. The anterior chamber of the left eye was somewhat shallow downward. On the iris there were, inward and upward, two small pits, which clinically correspond to case 1. The larger pit was situated close to the iris frill and had

upon its brownish-yellow floor five small black dots. The other smaller one was somewhat below and external to the first and connected with it by a small furrow. Otherwise the iris is without any special interest. Tension

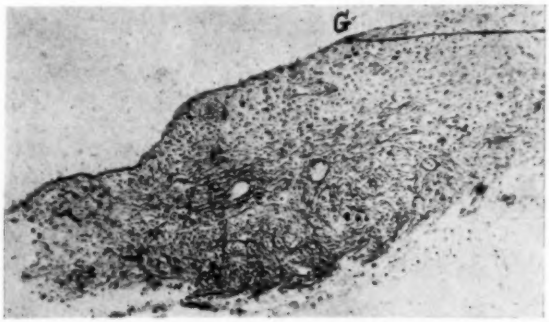

Fig. 4. Depigmented section of iris in Case 2. G. vitreous membrane seen with Zeiss objective I ocular AA.

26 mm. Hg. Field of vision normal. Vision R. = 6/4, V. L. = 2/200. By means of iridectomy and subsequent tattooing, the vision of the left eye was increased to 6/60.

Histology: The histologic pictures of this case resemble the first case

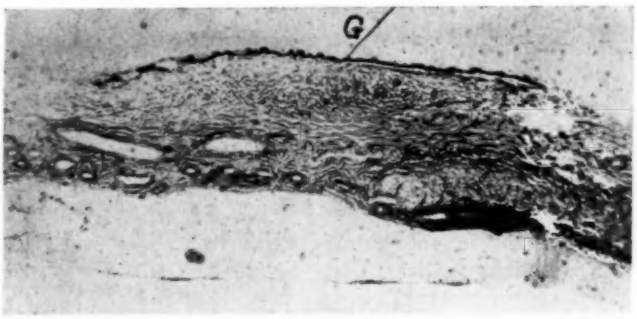

Fig. 5. Depigmented section of iris, Case 3. G. position of vitreous membrane. Enlargement same as Fig. 4.

essentially. A flat depression, corresponding to the groove was also observed here, and the formation of the membrane was similar in character, the only difference being that the iris adjacent to the membrane was less pigmented. (Fig. 4 depigmented section.)

Case 3. In 1919, a man, 50 years of age, developed a large adherent leucoma of his right eye following a severe corneal inflammation. He visited the clinic in May, 1922. He had trachoma and pannus on both sides. On his right eye there was in addition a 2.5 mm. large adherent leucoma, external and downward from the center. There were also visible in the iris numerous small pits similar to those mentioned before. But these latter have a more complicated shape, as the illustration shows (Fig. 7.), and are situated exclusively in the ciliary portion of the iris. There were no posterior synechiae. The lens was totally cloudy. No sign of glaucoma. On May 1, cataract extraction with iridectomy.

Histologically this case was also substantially similar to the first two cases reported. (Fig. 5 depigmented section.)

The following cases were also examined clinically.

Case 4. A woman 33 years of age. In her second year she suffered from an inflammatory eye affection, resulting in complete blindness of her right

eye, and on her left eye there developed a large leucoma. Right phthisis bulbi. Her left eye had trachoma with pannus, and a large adherent leucoma downward. In the iris, corresponding to the upper part of the iris frill, there was an oblique, narrow, sharply defined depression of about 3 mm., with a brownish colored smooth floor. No sign of glaucoma. (Fig. 8).

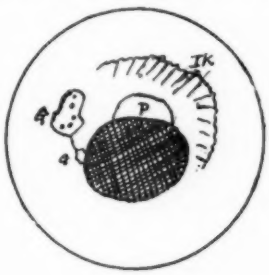

Fig. 6.

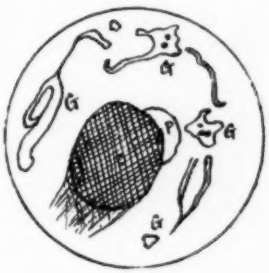

Fig. 7.

Fig. 6. Topography of cornea and iris in Case 2. G. pit, P. pupil, I.K. iris frill.
Fig. 7. Is topography of Case 3. Lettering as above.

Case 5. A youth aged 19 years. In his fourth year he had an inflammation of his eyes, which resulted in a leucoma of his right cornea.

At about the center of the right cornea an adherent leucoma, 2.5 mm. in diameter, was noticed. At the upper ciliary portion of the iris, a well defined small depression having a smooth yellowish-brown floor was seen. One extremity of the latter is in communication with a contraction furrow. (Fig. 9).

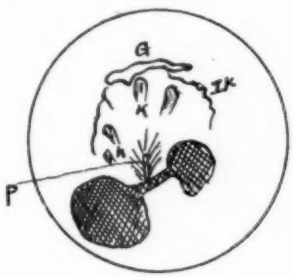

Fig. 8.

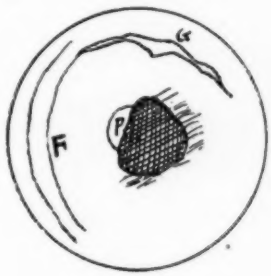

Fig. 9.

Fig. 8. Lesions of Case 4. Lettering as for Fig. 6.
Fig. 9. Lesions of Case 5.

Case 6. A man 24 years of age, who shortly after birth had an inflammation of his left eye terminating in a 4 mm. adherent leucoma of the cornea. In the pupillary portion of the iris, somewhat below the cicatrix, a sharply defined hole was noticed, whose smooth floor was colored yellowish-brown and had two small dots. No symptom of glaucoma. V.L. = 2/200. (Pl. 1. Fig. 10).

Case 7. A man, aged 22 years, contracted in his fourth year a cloudiness of the cornea of the left eye. An adherent leucoma was found, taking in about the middle two-thirds of the cornea. In the ciliary portion of the iris, above and outward, and upward and inward, two longish, shallow pits each of about 2 mm. in length were found. Tension normal. Light projection good. (Fig. 11).

Case 8. A man, 23 years of age. In his 19th year had gonorrhea of both eyes. Now he has trachoma and pannus of both eyes. On the right cornea above and inward an adherent leucoma, half the size of a seed of rice, was visible. In the iris downward and inward, close to the median pupillary border, an irregular annular, sharply defined pit, of typical nature, was found. (Fig. 12). Besides, in the visible ciliary and pupillary parts of the iris, numerous pits occurred. Those present in the

pupillary zone are mostly very small, and show thru their intercommunication, a very complicated picture. No sign of glaucoma. V.R. = 6/60.

Case 9. A man 48 years of age. In his 17 to 18 year he had an affection of the cornea of his left eye. In the center of the left cornea one notes an adherent leucoma. Toward the center, after an inflammation of the corneae in her 9th year, she retained a leucoma of each eye. Nystagmus and convergent strabismus of the right eye. In the right cornea, near the upper median limbus, a small adherent leucoma was situated. In the iris to the right and upward a number of small round pits were observed. Below the

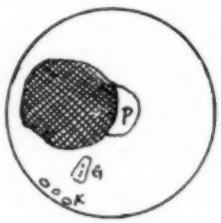

Fig. 10.

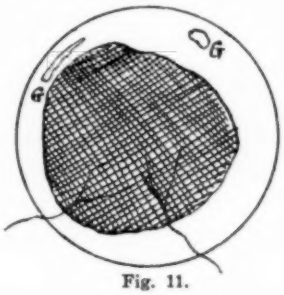

Fig. 11.

Fig. 10. Is lesions of Case 6. Lettering as above.
Fig. 11. Lesions of Case 7. Very large leukoma. Pits at G.

at the ciliary portion of the iris, three small pits were seen, sharply defined and floors colored a yellowish-brown. V.L. = 6/24. Tension normal. (Fig. 13).

Case 10. A man aged 20 years. At 3 to 4 years he had gonorrhea of both eyes, leaving in the center of the right cornea a slight cloudiness. The left cornea had, outward and above, a dense round cloudiness adherent with the iris and about 3 mm. in size. Inward and upward in the iris, in the vicinity of the iris frill, two physiologic crypts were visible, and between these and pointed upward and below inward, there were seen two small pits of typical nature. (Fig. 4.) Tension normal.

Case 11. A girl 17 years of age. cicatrix between the iris and the cornea, another, somewhat larger pit was found. In the left iris upward and inward and close to the lower portion of the cicatrix between the iris and the cornea, two small pits were seen, the first one hoe shaped, the other irregularly net shaped. The left lens is cloudy at its anterior pole. No increase in tension.

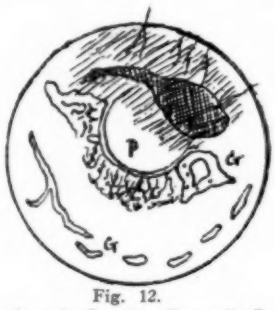

Fig. 12.

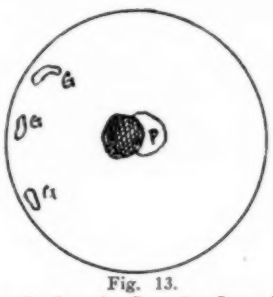

Fig. 13.

Fig. 12. Lesions in Case 8. P. pupil, G. iris pits.
Fig. 13. Lesions in Case 9. Same lettering.

SUMMARY.

Recapitulating briefly the above mentioned clinical and anatomic reports, we find in eyes with adherent leucoma, mostly of long standing[1], sometimes in the pupillary portion, at other times in the ciliary portion of the iris, a peculiar small pit, which is sharply defined and is characterized by

the yellowish-brown color of its smooth floor, and by that means differentiated from the physiologic cryts. Their shape, size and number differ greatly. Histologically we find a thin homogeneous membrane covering the

Fig. 14. Lesions in Case 10. P. pupil, K. iris crypts, G. pits.

floor of the pit, which stains slightly red with eosin, light red with van Giesen and darkly violet with elastin. It is without doubt, that this membrane acts like a vitreous formation upon the iris. The connection of the membrane with its under layer is not a firm one. The free upper surface of the membrane is mostly bare, but in

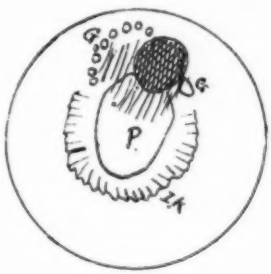

Fig. 15.
Fig. 15. Case 11, right eye. Lettering as before.

places it is invested with single rows of flat pigmented cells, at times island shaped and sometimes ranged continuously. Otherwise there were no changes worth mentioning. The occurrence of a vitreous membrane on the anterior surface of the iris is a well known histologic picture. The first communication relating to this condition came from Donders[4]. He observed a case, where the periphery of the iris was cicatrized with the cornea after a severe inflammation of the internal eye, of a newly formed vitreous membrane, which in the periphery was connected with the thickened Descemet's membrane. In another case there was an organized exudate in the anterior chamber and the vitreous membrane was found upon this exudate. Donders thought, that the newly formed vitreous membrane in the first case resulted from proliferation of the ligamentum pectinatum, and in the second case from the organized exudate.

Wagenmann[2 and 3] was the first to call attention to the fact, that the endothelium of Descemet's membrane, the epithelium of the capsule and the pigmented epithelium of the choroid had the power to reconstruct vitreous membrane. In the cases observed by him, the formation of a vitreous membrane upon the iris and of the socalled endothelial connective tissue in the anterior chamber, and also the proliferation of endothelial cells which were found closely connected with the endothelium of the posterior surface of the cornea, were placed on record. This opinion of Wagenmann was accepted by some recent authors. This likely explains the cases where the

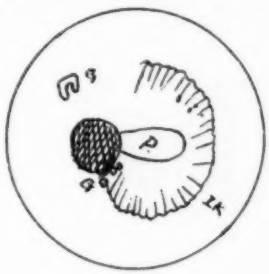

Fig. 16.
Fig. 16. Case 11, left eye. Lettering as above.

newly formed vitreous membrane is in direct communication with Descemet's membrane and the endothelium on the posterior surface of the cornea, but it does not explain those cases where this does not occur.

In the cases before me, while I was not able to examine the entire eye histologically, the vitreous membrane upon the iris was assuredly not connected with Descemet's membrane, or with the endothelium of the posterior surface of the cornea. It appeared upon the iris, not diffused, but in the shape of islands in different

parts. That the angle of the anterior chamber was invaded by newly formed endothelium, is not probable, inasmuch as the intraocular tension was found to be normal in all cases. To be sure, there were synechiae between the iris and the cornea in my cases. Consequently it seems possible, that the endothelium on the posterior surface of the cornea gives rise to the continuous formation of vitreous membrane from these cicatrized parts implanted in the iris. As the small pits or cavities and the formation of the vitreous membrane were found in all the rest of the nine cases distant from the cicatrix, with the exception of two cases, it seems safe to exclude this possibility. The participation of the endothelium of the lens capsule in the formation of vitreous membrane does not come into consideration, as no posterior synechiae were proven and cloudiness of the lens was apparent only in two cases, 3 and 11.

I believe, therefore, that the causation of the formation of vitreous membrane from the endothelium of the posterior surface of the cornea is very improbable in my cases. For this reason it becomes necessary to explain the formation of the vitreous membrane differently.

Some time ago Uhthoff and Axenfeld published a remarkable report on the behavior of the endothelium in serpigenous ulcer of the cornea, which is not without importance to the interesting question at issue. Both authors state, "the endothelium on the posterior surface of Descemet's membrane, demonstrated in our cases, often showed a detachment or an atrophy, in an otherwise well preserved Descemet's membrane. Especially distinct were these changes in that part of the membrane corresponding to the seat of the ulcer. In parts the detached debris of the endothelium were lying like giant cells, disengaged in the hypopion in the anterior chamber, while in other places a layer of leucocytes had pressed itself between the endothelium and Descemet's membrane and detached the same. In parts a proliferation of endothelium had taken place; especially noticeable was this in sections of inoculative keratitis, where in parts a warty thickening had taken place on the posterior surface of Descemet's membrane. The endothelial cells showed mostly distinct pathologic changes as necrosis, swelling and difficulty in staining of the nuclei, etc. Very remarkable is case 5, where in one spot in the anterior chamber the desquamation of the endothelium with simultaneous enlargement of the separate cells was observed, the same having very long branches, were star shaped, and had a great resemblance to much enlarged corneal cells, suitable parts of the section permitting the view of the evolvement of the large arborescent cells directly from the detaching endothelium of Descemet's membrane."

Saemisch[11], Greeff[5], and Akiya[1] have noticed similar changes in the endothelium in Descemet's membrane in serpigenous ulcer of the cornea. Opin observed one case of traumatic iridocyclitis where the endothelium of the posterior surface of the cornea became detached in several places.

As I have mentioned, all my cases concern eyes with adherent leucomas of the cornea. It is therefore not excluded, that a small piece of endothelium from the posterior surface of the cornea became detached from its parent soil while the affection of the cornea was in progress, was implanted upon the surface of the iris, and later gave rise to the formation of the vitreous membrane. According to my judgment, this possibility of the formation of vitreous membrane appears very improbable. The detached endothelium in the anterior chamber would in such a case be degenerated and not be able to proliferate. Moreover the vitreous membrane in my cases is not always placed upon the lower half of the iris, but in different sites on the same.

Since I have mentioned the different possibilities in the formation of the vitreous membrane on the anterior surface of the iris, and rejected them all as improbable, I believe that only one

possibility remains to be considered, namely to trace the origin of the newly formed vitreous membrane to the endothelium of the iris itself. Wagenmann[14] previously mentioned such a possibility in the formation of the vitreous membrane. The pathologic proliferation of the endothelium on the surface of the iris has repeatedly been mentioned by Birnbacher-Czermak[3] and Alt[2] in glaucoma, and also by v. Michel in iritis. I am well aware of the fact, that the question of the existence of endothelium on the surface of the iris is still an unsettled one.

While Krückmann[8], Suganuma[12], and Wolfrum[15] deny its existence, Koganeii[9] in view of comparative anatomic researches considers it as proven. According to his view, most vertebrates have during their whole life a continuous layer of endothelium upon the upper surface of the iris. In man and gorillas, the endothelium is only found in the newborn. It never occurs in a continuous layer in adults, and can only be proven in small regions of the pupillary portion of the iris. v. Michel[9], Sattler[5], Fuchs[5] acknowledge its existence. I consider it worthy of notice that in the majority of the cases before us, the beginning of the affection of the cornea, which gave rise to the formation of adherent leucoma of the cornea, happened in early childhood and adolescence. As was histologically proven in the cases before us, the flat pigmented cells covering the free surface of the iris could perhaps be endothelial cells of the iris.

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SLIT LAMP STUDIES OF HERNIA OF THE VITREOUS. ITS RELATIONS TO CATARACT OPERATIONS.

LUTHER C. PETER, M.D.

PHILADELPHIA.

This is a preliminary report of cases of prolapse of the vitreous into the anterior chamber after various cataract operations; or spontaneous absorption of the lens. They were studied with the corneal microscope and slit lamp, revealing various conditions of the parts. Read before the Section of Ophthalmology of the College of Physicians of Philadelphia, February 15, 1923. See p. 691.

The term "hernia of the vitreous" has been applied to several clinical conditions, usually associated with trauma of some kind. Elschnig used the term to describe a protrusion of the vitreous thru the cribriform membrane in a variety of glaucoma simplex. A number of cases of prolapse of the vitreous into the anterior chamber after dislocation of the lens have been reported in the literature. The form of hernia of the vitreous which is under consideration in this communication is a prolapse of part of the vitreous body into the anterior chamber thru the iris, after various forms of cataract operations and spontaneous absorption of cataractous lens without operative interference.

With the introduction of the Gullstrand slit lamp and point-o-lite lamp, the corneal microscope has opened a vast and heretofore unexplored field of observation, at least in so far as minutiae of details is concerned. With a low magnification of only twenty-four, the slit lamp offers an illumination for exploring the anterior chamber, the lens and the vitreous body several millimeters back of the lens. This magnification was found to be the best for the studies in the group of cases herewith reported. In this group are included vitreous prolapse in cases of spontaneous absorption of a cataractous lens, prolapse after the intrascapular method of extraction by Smith and by Barraquer, after discission for secondary cataract, and studies after the ordinary method of extraction.

The first group of cases is well illustrated in a man of 44 years who developed a traumatic cataract some years ago, associated with glaucoma, sclerosis of the choroid, and posterior uveal disease. The fibrous remnants of the absorbed cataract spontaneously became detached, being adherent at one point below. It now moves back and forth like a valve with the movements of the globe. When the anterior chamber is explored, there is a rounded gelatinous mass found in the anterior chamber, covered by the hyaloid membrane, distinctly limited. This mass surges back and forth with the movements of the globe, with graceful undulating curves as tho it were a living body. On the surface can be observed at least parts of the hyaloid membrane, which is thrown into more or less vertical folds; and thru the volume of the protuding bead can be seen, by shifting the light, trabeculae which make up the framework of the vitreous body. At times the entire mass recedes within the vitreous chamber, and again it surges forward and spreads out over the anterior surface of the iris. But at all times the lines of demarcation are distinct when sharply focused. Altho vitreous prolapse is assigned as a cause of glaucoma, in this particular case the glaucoma undoubtedly preceded the prolapse. The patient has aphakic vision limited to a small area surrounding the macula.

A second case in this group is that of C. L., aged 14 years, who developed a traumatic cataract after explosion of a dynamite cartridge. The lens was partly prolapsed into the anterior chamber and in this position became absorbed. Examination by means of the slit lamp shows the capsule present in the lower part of the pupillary space, but above the vitreous extends well into the anterior chamber and spreads over the anterior surface of the iris. As in the first case the iris moves back and forth with the move-

ments of the globe. Vision is 6/5 with correction.

A second group of unusual interest is that of prolapse after discission of a membranous cataract. The first patient is a woman of 55, who was examined before and after discission. Before operation the vitreous, altho fluid, was held in place by the hyaloid membrane and the posterior capsule. A thin adventitious membrane had formed and covered part of the pupillary space, as the result of a prolonged iridocyclitis, incident to an opening of part of the wound on the ninth day after extraction. The patient had sustained an accidental trauma.

A week after the knife needle was used to clear the pupillary space, the anterior chamber was explored by slit lamp microscopy. A hernia, similar to that found in the first case, altho different in many respects, was found to occupy the anterior chamber. No evidence of the folds of the hyaloid membrane were visible and, while definitely limited in certain areas, a sharp dividing line was not apparent. One could differentiate vitreous from the aqueous by the presence of very fine pigmented dust like particles and the appearance of wavy trabecules, as the mass surged back and forth thru the capsular opening. At times it disappeared entirely within the vitreous chamber. The patient's vision with correction is 6/9+. Three other patients which have fallen under the writer's care recently have been examined, and in each instance after a discission of secondary cataract a vitreous hernia has been encountered.

In discussion of the Barraquer operation for cataract at An International Congress of Ophthalmology held in Washington last April, the opinion was freely expressed that the removal of the lens in its capsule would undoubtedly weaken the wall which held the vitreous in place, as nothing but the hyaloid membrane remained. With this thought in view, a study of the conditions as they appear after the Smith, Barraquer, and ordinary extraction with capsulotomy was begun. The number of cases examined in the first and second groups is too small from which to draw conclusions. The few cases at hand, however, are instructive.

The case of Mr. G., aged 74, offers the rare opportunity of studying the Smith and Barraquer, side by side. Thru the courtesy of Dr. Holloway and Dr. Appleman, it was the writer's privilege to examine this patient. Colonel Smith operated on the left eye two years ago, and Dr. Barraquer extracted the right lens last April. The gross appearance of the left eye by the Smith method is fair. The iris is drawn up into the wound, the anterior chamber is shallow, the iris being adherent to the wound above and to the nasal side, while there is in addition an iridodialysis between the periphery and cut edge of the iris. Tension is normal. The slit lamp, with 24 diameters of magnification, confirms the gross findings. In addition, the iris is in contact with the posterior surface of the cornea and the corneal scar for a much greater length than observed by the ordinary methods of examination. The outer corner of the iris is also caught in the scar. The hyaloid membrane is smooth and presents an even surface, on the temporal side occupying a more forward plane than the nasal edge or border. There are oblique folds or striations extending from an iris tag up and out to a downward and inward direction. On the capsule are numerous fine granules of iris pigment. The vitreous in its anterior layers contains no undue number of opacities. The normal trabeculae of its framework move freely in a semi-fluid vitreous substance. Vision in this eye is 6/15 partly. It probably might be improved by a new correction.

The right eye, which Barraquer operated on, furnishes the external appearance of a perfect technic. The anterior chamber is deep, the iris coloboma small and not drawn up. The iris is tremulous. With slit lamp illumination the microscope reveals a clean cut scar along the line of incision without incarceration of iris tissue or other tags. There is, however, a hernia of the vitreous which extends

at times almost to the posterior corneal surface. The hyaloid membrane is seen in irregular delicate vertical folds as the light is shifted, and in addition to the normal vitreous trabeculae there are vitreous opacities. Vision in this eye is 6/9. The ophthalmoscope in both eyes shows a pale disc with considerable cupping, greater in the right than the left. The right eye contains numerous opacities. The left eye is free from opacities. The corneal findings which are about the same in both eyes are not germane to the subject matter of the paper.

From an external examination the Barraquer method has every appearance of a classic. From within, however, there is vitreous prolapse and marked vitreous opacities. It is within the range of possibilities that the latter symptom may have preceded the operation. The external appearance of the Smith operation is only fair, much below the average. Internally, however, the vitreous is well held in place and there are no vitreous opacities.

Mrs. S., 65 years of age, was operated on by the writer about four months ago by the Smith method. The coloboma is unduly wide but the iris is not drawn up into the corneal scar. The vitreous is held well in place by a smooth hyaloid membrane. Vision is 6/5. The vitreous is fluid and contains some opacities.

Mrs. F., aged 65, was operated on by Dr. Barraquer last April. According to instructions the eye was allowed to remain closed for one week after operation. This was during the week of the Washington Congress. For twenty-four hours after the operation the patient vomited and was much depressed. Fortunately the corneal flap was stitched in place. When the dressing was removed the anterior chamber was found to be filled with blood. This necessitated a stay of three weeks in the hospital.

Her condition now is as follows: A small peripheral iridectomy was performed. Like the other Barraquer case the external appearance shows a perfect technic excepting for a tremulous iris. The slit lamp, however, discloses fluid vitreous pouring thru the pupillary space and thru the peripheral iridectomy opening. The hyaloid membrane is visible only in spots. In the lower part of the anterior chamber the vitreous can be differentiated from the aqueous with the greatest difficulty only by the appearance of small pigmented dust spots and the appearance of fine trabeculae. Vitreous opacities are numerous and massive. Vision is 6/6.

In the cases examined in which extraction was performed by the usual method with capsulotomy, there were no instances of vitreous prolapse, altho in one case there was some loss of vitreous at the time of the extraction.

The number of cases herewith reported is too small from which to draw general conclusions. Each case, however, in itself admits of analysis. If we compare the four cases, two by Barraquer and two by the Smith method, one by Smith and the other by the author, the results are not without interest. From the standpoint of perfect operative technic, both Barraquer's are perfect. Both, however, have tremulous irides, both have marked vitreous hernia and both have more than the usual number of vitreous opacities. Altho one of the Smith operations is far from perfect from external appearances, conditions in the interior of the eye in both cases are most satisfactory. Omitting the section and the iridectomy, it is evident that more trauma was applied to the delicate hyaloid membrane by the suction method than by expression by pressure from without. If this is true in the clever hands of the master of the method, it will be more so in the hands of one who is less skillful and has had little training in the operation.

It is not probable that many, if any, surgeons will attempt to practice the suction method. The Smith method on the other hand, or its modifications, will be used in selected cases by a limited number of surgeons. It can be performed with excellent results in selected cases and without a drawing up of the iris coloboma. It is of much

importance, therefore, that further studies be made with the slit lamp, not only in the intracapsular cases, but in the operations performed by the usual method.

Returning to the discission group, we have certain matters to consider. First, does the presence of a hernia of the vitreous in the anterior chamber jeopardize the integrity of an eye? May the presence of a hernia lead to complications? Altho the writer has not searched the literature thus far for specific cases so recorded, the opinion is generally accepted that vitreous in the anterior chamber may cause glaucoma. In a very large proportion of cases of glaucoma which develop after cataract extraction as secondary glaucoma, tags of iris and capsule caught in the wound are found to explain the development of this complication. It will, however, be a study of much interest in the future to determine in how many of these cases of secondary glaucoma not accounted for, a hernia of the vitreous may be detected by proper slit lamp microscopy.

Fuchs and others have called attention to the frequency of retinal detachment after the Elliot sclerocorneal trephining and after cataract extraction. In most instances this detachment is temporary. In a few instances it may be permanent and serious. The reason is obvious. Added to the sudden removal of the support from in front by the extraction of the lens, the surging back and forth of the vitreous in an eye, now subnormal in tension, may increase the tendency to detachment of the retina. The vitreous is normally and firmly attached to the ora serrata and to the structures about the nerve head. Negative pressure from within by the constant movement of the vitreous may, therefore, result in detachment of this membrane.

Altho discission has been practiced for many years seemingly without serious injury to the eye, just as posterior sclerotomy has been performed, without assured impunity, the disturbed relations resulting therefrom, and the damage to the vitreous, may not be so indifferent as we are accustomed to regard them. At all events, it is safe to say that the average ophthalmic surgeon has a most comfortable feeling if he can extract a cataract so carefully that a subsequent needling operation need not be resorted to. The satisfaction of the operation so performed is not wholly one of pride in technic and skill, but underneath it all there is a feeling of safety, in that he need not subject his patient to the further risk of a subsequent needling. The consciousness of a certain amount of risk is present even tho it is minimized to the patient. If the surgeon will take the interest and opportunity of studying conditions in the anterior chamber with a slit lamp after he has cut an opening thru an after cataract, it is the writer's conviction that the surgeon will have a greater respect for the integrity of the vitreous body. He will also take a renewed interest in perfecting his technic in cataract extraction in order that a discission, however harmless it may seem, need not be performed.

The brief studies herein reported are only preliminary. They are necessarily incomplete as are most studies with the slit lamp in microscopy of the eye. A subsequent report, however, will be made when it is hoped abundance of material may throw more light upon some of the points raised for discussion.

THE BACTERICIDAL POWER OF ARGYROL.

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This is the report of results of experiments made at the Massachusetts Charitable Eye and Ear Infirmary. The contradictory results of experiments made with argyrol heretofore published are reviewed. Experiments with two varieties of technic show that with bacteria well separted argyrol is an affective bactericide. But organisms exposed in clumps or masses are so protected that many of them escape its influence. Even under favorable circumstances, its bactericidal effects is less than that of protagol or silver nitrat, the last being the most efficient. Read before the New England Ophthalmological Society.

Argyrol has been used by ophthalmologists for about twenty years, numerous reports, clinical and laboratory, have been made upon its bactericidal power, and the end result seems to be that, in spite of distinctly damaging laboratory evidence, there are many men of great clinical experience who still have faith in it. Indeed the widespread use of argyrol presupposes belief in its efficiency. Verhoeff[1] found that argyrol in 12% solution failed to kill staphylococci after an exposure of 1 hour. Verhoeff[2] also found that hydrocele fluid inhibited the germicidal action of argyrol. Derby[3], later, in 1906, obtained abundant growth of staphylococcus aureus after 3 1/2 hours exposure to 50% argyrol mixed with hydrocele fluid, and concluded that argyrol was almost inert but sterile and soothing. Post and Nicoll[4] found that 10% and 50% argyrol failed to kill pneumococci after exposure for 1/2 hour. Silver nitrat was much more effective. Dakin and Dunham[5] found that 5% argyrol acting on staphylococcus aureus gave a growth at end of 6 hours, but however showed some diminution in the amount of growth at the end of five minutes, which is a point to be noted. Young[6] using 10% argyrol in urine acting on staphylococcus aureus obtained a negative culture in 15 minutes. Indeed, with the exception of Young's report, the laboratory evidence was very much against argyrol, and there the matter more or less rested until Lancaster[7] in 1920 published laboratory evidence very much in favor of argyrol, inasmuch as his results convinced him that it was a "powerful *antiseptic* as tested on staphylococcus aureus in serum or in salt solution or water" being effective in as weak solution as 1%. He showed that it had bactericidal power, and with 20% solution obtained a negative culture in as short a period as 2 minutes. In short, here was a break between laboratory and clinical evidence, and, at the suggestion of Dr. Verhoeff, I undertook to repeat his and Dr. Derby's work in an effort to find out why their results were so widely variant from Lancaster's, or in other words, to determine whether argyrol was "almost inert" or actually a "powerful antiseptic." The organisms employed in these tests were various strains of staphylococcus aureus, and in carrying out the tests two main variations in technic were employed which will be designated technic "A" and technic "B".

Technic A.

The procedure, employed by Verhoeff and Derby, was adopted, and with some variations, was as follows:

1. The water of condensation of a slant of Loeffler's Blood Serum was inoculated with staphylococcus aureus, and run over the surface of the slant. In 24 hours there was a profuse growth of staphylococcus, and by scraping all the colonies on the surface of the slant down into the water of condensation, a dense suspension of the organism was obtained.

2. A platinum loop 3 mm. in diameter was employed, and two loops of the above suspension of bacteria mixed with 2 c.c. of argyrol solution in a small glass receptacle with a cover.

3. At various intervals (at every 10 minutes for first hour and thereafter every 15 minutes up to 2 to 3 hours) a loop of the above suspension of staphylococci in argyrol was placed in the water of condensation of a tube of Loeffler's Blood Serum (the amount

of water of condensation being 1 1/2-2 c.c. in order to dilute the small amount of the argyrol, etc. carried over on the loop) and mixed. The water was then run over and growth observed at end of 24 hours. If a culture was found to be negative, it was run over again and observed at end of another 24 hours.

In the first series 25% argyrol was used (straight and mixed with equal parts of hydrocele fluid.) Series of cultures were run thru both at incubator and room temperature, four different strains of staphylococci being used. The growth was found to be so profuse that it was often impossible to distinguish separate colonies, which necessitated tabulating the results in the following manner. (See tables A, B, C, and D.)

Now, under the following headings, let us analyze the results of the foregoing series of experiments and see what conclusions we may be justified in drawing.

A. *Marked Diminution of Growth*:—

1. Shortest time at which observed —20 minutes.
2. Longest time at which observed —4 hours (no diminution even.)
3. Average time at which observed —2 hours.

B. *Longest Interval at which growth obtained and First Negative Culture*:—

Due to the fact that these series of cultures did not extend beyond a period of 3-4 hours (a germicide that did not kill at end of 3-4 hours being considered as of doubtful clinical value as such) it can merely be stated that:

1. Longest interval of growth was, with two exceptions, 3-4 hours and longer.
2. In 80% of the series a negative culture was not obtained even at end of 3-4 hours.

C. *Different strains of Staphylococci*:—

Another point to be considered is the variation in results to be obtained by using different strains of staphylococci, and it certainly seems that this is a factor to be considered, since Strain II was definitely more resistant as evidenced by the facts that:

1. The average time of Diminution of Growth in Strain II was 2 1/2 hours, while in Strains I, III, and IV, it averaged about 1 3/4 hours.
2. No negative cultures were obtained with Strain II while several were obtained with other strains.

D. With one exception (see table D last series) argyrol apparently was somewhat more effective at incubator than at room temperature—so all future work was done at incubator temperature. However, I do not believe temperature is a very important factor, there being other factors that can cause much greater variations.

Thus, briefly summarizing, the most striking points are that the average time of diminution in growth is 2 hours, and that in 80% of the series you get varying amounts of growths even after 3-4 hours. It was a great temptation to consider argyrol inert on such evidence, for it would seem hard to believe that a solution which could not cause diminution in growth until after 2 hours, could be of much use in the conjunctival sac where it could not remain in concentration for over a few minutes at the most.

Further experiments were carried on and, in an endeavor to investigate all factors which might cause marked variations in results, it was decided to see what the effect of reducing the number of bacteria to a unit volume of argyrol would be.

Taking 2 c.c. of 1% argyrol and hydrocele fluid (1 c.c. of 2% argyrol and 1 c.c. hydrocele fluid) and adding to it 1 loop of the bacterial suspension instead of 2 (See technic A), the following results were obtained on taking cultures:

24 hours—profuse growth.
48 hours—profuse growth.
72 hours—100 colonies.
96 hours—1 colony.

These results were, as is evident, not very satisfactory, so the number of bacteria was still further reduced by taking a straight platinum wire without a loop, dipping the end in the bacterial suspension and thus transferring an even smaller number of bacteria to

2 c.c. of 1% argyrol (with and without hydrocele.) Four separate experiments showed:

24 hours—no growth.
48 hours—no growth.
72 hours—no growth.

Note: Controls in salt solution* taken at above intervals showed a profuse growth of staphylococci.

In other words, reducing the number of bacteria seemed to give better results and with this point in view, "technic B" was developed. It will be sufficient to note the essential points of difference from "technic A" which has been fully described. These points are:

1. A small bottle was used, instead of an open receptacle with a glass cover,—and the bacteria could be more easily mixed with the germicide.
2. 10 c.c. of the germicide was used instead of 2 c.c. (2 loops of suspension still being used.)

In other words, the main difference was the use of fewer organisms to the unit volume of germicide. Using the above modified technic, it was found on six separate attempts that, after 1 to 2 minutes exposure of the staphylococci to a 1% argyrol solution, at the end of 24 hours the amount of growth varied from 0 to 10 colonies. This was most astounding as controls in all cases showed profuse growth, and there was no conclusion to be drawn except that a 1% argyrol solution had actually killed a large number of staphylococci in the short period of 1-2 minutes (in some instances, even a negative culture was obtained.)

It is most striking when you stop to consider the results in the first series of experiments where the average time for even a diminution of growth was 2 hours, and I should again like to emphasize the point that the only important variation in technic was that fewer organisms were used per unit volume of argyrol.

Having ascertained that the number of organisms per unit volume of argyrol had such tremendous influence on the results, a large number of series was run thru according to "technic 'B'."

1% and 25% argyrol and 1% and 4% protargol were used with and without mixture with hydrocele fluid. Most series were run thru in duplicate to see how series under absolutely identical circumstances might vary. The results are tabulated below, the time at which cultures were taken

TABLE A. (Strain I. Staphylococcus).

	S.I.	S.O.	S.I.	S.O.	
Marked Diminution of Growth	1¼	2	2½	3	hours
Longest Interval at which Growth Obtained	1¾	3	4	4	"
First Negative Culture	2	4	N	N	"

TABLE B. (Strain II. Staphylococcus).

	S.O.	S.I.	P.O.	S.O.	P.I.	S.I.	P.O.	S.O.	
Marked Diminution of Growth	..	3	½	2¼	..	..	2½	2½	hours
Longest Interval at which Growth Obtained	4	4	4	4	3	3	3	3	"
First Negative Culture	N	N	N	N	N	N	N	N	"

TABLE C. (Strain III. Staphylococcus).

	S.O.	S.I.	S.O.	S.I.	
Marked Diminution of Growth	2½	2	1¾	5/6	hours
Longest Interval at which Growth Obtained	4	4	3	1¼	"
First Negative Culture	N	N	N	1½	"

TABLE D. (Strain IV. Staphylococcus).

	S.O.	S.I.	S.O.	S.I.	
Marked Diminution of Growth	1¼	5/6	1½	1¾	hours
Longest Interval at which Growth Obtained	4	4	3	4	"
First Negative Culture	N	N	4	N	"

P—25% argyrol straight.
S—Equal volumes of 50% argyrol and hydrocele fluid.
O—Experiments carried on outside incubator, i.e., room temperature.
I—Experiments carried on inside incubator (37.5)
N—Negative cultures—not obtained.

*It is important that normal salt solution should be fresh, as we have found that old salt solution becomes germicidal.

being indicated by hours or fractions thereof, the numbers in the squares being the number of colonies obtained. Where no growth was present at 24 hours the water of condensation was run over and the growth, if present after 24 hours, was recorded as "+" below the horizontal line in the square. Stat. = culture taken as soon as organism introduced into the germicide, probably about 30 seconds of exposure in all.

SERIES II (TECHNIC "B")

TABLE E.

Time (hrs.)	Stat.	½	1¼	2	3	4	5	6	24
1% Argyrol	200	4	0	0	1	0	0	0	0
	—	—	—	—	—	—	—	—	—
			+	0		0	0	0	0
1% Argyrol	120	3	3	0	0	0	1	1	0
	—	—	—	—	—	—	—	—	—
				0	0	0			0
25% Argyrol	80	7	1	1	0	0	1	1	0
	—	—	—	—	—	—	—	—	—
					+	0			0
25% Argyrol	80	12	0	0	0	0	0	0	0
	—	—	—	—	—	—	—	—	—
			0	0	+	0	+	0	0
1% Argyrol hydrocele	200	3	2	20	1	1	0	0	0
	—	—	—	—	—	—	—	—	—
							0	0	0
1% Argyrol hydrocele	150	2	20	2	2	1	1	2	0
	—	—	—	—	—	—	—	—	—
									0
25% Argyrol hydrocele	150	50	7	12	7	1	0	0	0
	—	—	—	—	—	—	—	—	—
							0	0	0
25% Argyrol ē hydrocele	200	20	16	0	1	0	0	1	0
	—	—	—	—	—	—	—	—	—
				0		0	0		0
1% Protargol	1	0	0	0	0	0	0	0	0
	—	—	—	—	—	—	—	—	—
		0	0	0	0	0	0	0	0
1% Protargol	0	6	1	0	0	0	0	0	0
	—	—	—	—	—	—	—	—	—
	0			0	0	0	0	0	0
4% Protargol	1	0	0	0	0	0	0	0	0
	—	—	—	—	—	—	—	—	—
		0	0	0	0	0	0	0	0
4% Protargol	0	0	0	0	0	0	0	0	0
	—	—	—	—	—	—	—	—	—
	0	0	0	0	0	0	0	0	0
1% Protargol ē hydrocele	100	20	11	4	2	0	0	1	0
	—	—	—	—	—	—	—	—	—
						0			0
1% Protargol ē hydrocele	100	24	0	0	1	1	1	1	0
	—	—	—	—	—	—	—	—	—
			0	0					0
4% Protargol ē hydrocele	50	6	1	0	0	0	0	1	0
	—	—	—	—	—	—	—	—	—
				0	+	+	+		0
4% Protargol ē hydrocele	100	12	7	1	0	0	0	2	0
	—	—	—	—	—	—	—	—	—
					+	0	+		0

NOTE—Controls in salt solution showed profuse growth.

TABLE F.

Time (hrs.)	Stat.	¼	½	¾	1	2	3	4	5	6	7	24	48
1% Argyrol	0				0	0	0	0	0	0		0	
	—				—	—	—	—	—	—		—	
	0				+	0	0	0	0	0		0	
1% Argyrol	0				0	0	0	0	0	0		0	
	—				—	—	—	—	—	—		—	
	0				0	0	0	0	0	0		0	
25% Argyrol	33				0	0	0		0		0	0	0
	—				—	—	—	—	—		—	—	—
					+	0		+	0		0	0	0

25% Argyrol	7				0	0	0	0	0		0	0	0
					0	0	0	0	0		0	0	0
1% Argyrol ē Hydrocele	P				6	1	0	0	0	0		0	0
							0	0	0	0		0	0
1% Argyrol ē Hydrocele	P				0	1	0	0	0	0		0	0
					0		0	+	0	0		0	0
25% Argyrol ē Hydrocele	35				15	3	0	0	0	0		0	
							0	0	0	0		0	
25% Argyrol ē Hydrocele	40				26	8	12	1	0	0		0	
									0	0		0	
1% Protargol	0	0	0	0	0	0	0	0	0		0		
	0	0	0	0	0	0	0	0	0		0		
4% Protargol	0	0	0	0	0	0	0	0	0		0		
	0	0	0	0	0	0	0	0	0		0		
1% Protargol ē Hydrocele	32	0	0	0	0	0	0	0	0		0		
		+	+	0	0	0	0	0	0		0		
4% Protargol ē Hydrocele	28	0	0	0	0	0	0	0	0		0		
		0	0	0	0	0	0	0	0		0		

NOTE.—Controls on salt solution made at once and at intervals up to 24 hrs. showed profuse growth but separate colonies not recognizable as such.
P—Profuse growth—colonies too numerous to count, but separate.

Now let us analyze the above series of experiments with special emphasis on the comparisons with the results shown in Series I. The results may be tabulated as folows:

A. *Marked diminution of growth*: this took place within 1-2 minutes invariably in 28 series of experiments with Argyrol and Protargol. The diminution ranged from an absolutely negative culture in many cases to 200 colonies (controls made simultaneously showed growth so profuse that separate colonies could not be distinguished as such). The average time for diminution in growth in Series I being 2 hours, one cannot help but be impressed by such a startling difference.

B. *Longest Interval at which growth obtained and First Negative cultures*: as may be seen by referring to tables, growth was obtained at as long periods as 4 and 6 hours, which compares fairly closely with Tables A. B. C. D. where growth was obtained at 3 and 4 hours (in more abundant quantities, however). Nevertheless, in some instances a negative culture was obtained in 1-2 minutes. (See tables.)

The situation can be summarized in the statement that my first series showed no diminution of growth for 2 hours on an average, while the second series showed diminution in 1-2 minutes. On the other hand, the longest interval at which growth was obtained, even in second series, was 4-6 hours, a positive culture cropping out every now and then when least expected.

There can be no getting away from the fact that, altho a very large percentage of organisms are killed by argyrol in 1-2 minutes, there are a few which are not killed even after 6 hours exposure. It does not seem probable that there would be such a great difference in the resistance of individual cocci in the same culture, and the logical explanation of this phenomenon would seem to lie in the fact that staphylococci have an inherent tendency to form clumps, and by so doing the organisms in the center of the clump are protected from the action of the germicides. Dr. F. L. Burnett[8] has kindly given me the benefit of his experience, that in making staphylococcus vaccines with a high concentration of organisms, if the suspension is not shaken up with the glass beads in order to break up the clumps, even after the usual exposure to heat, you will still obtain a positive culture from

the vaccine. I tried this out and found the same thing.

Going on the above assumption, the poor germidical action of argyrol in Series I, where a great many organisms were used per unit volume of germicide, can be most easily understood, for the more dense the suspension of cocci, the more numerous the clumps are bound to be, and thus there are more "protected organisms" which are able to escape contact with the germicide. In Series I the number of these protected organisms was so great that their growth on the Loeffler's slant was profuse enough to mask the diminution of growth which, nevertheless, must have been present.

Another interesting point is that in vitro, 1% argyrol seems to be fully as efficient a germicide as the 25%. The explanation of this may be that the number of active ions is about the same, the more dilute solution being more completely ionized.

The effect of serum now remains to be considered. Hydrocele fluid was used and results may be summarized in saying that:

Serum does impair the germicidal power of argyrol, but not to a very great degree as a view of Tables E and F will show.

Now as to a comparison with protargol: the latter is a more efficient germicide, but loses this advantage to a large degree when in the presence of serum, which inhibits the action of protargol proportionately more than argyrol (see Table E). However, when dropped in the conjunctiva, it can undoubtedly kill more organisms before it becomes inactivated, than argyrol under similar conditions.

As to silver nitrat (1%), it is a markedly more efficient germicide, as is shown by the fact that, employing "technic A" where the average first diminution of growth with argyrol was 2 hours, silver nitrat gave a negative culture at the end of five minutes, and always showed a marked diminution of growth at the end of two minutes or less. However, the well known irritant properties of silver nitrat are distinctly disadvantageous, when its use over any considerable period of time is considered. Also, it is not to be forgotten that serum inactivates $AgNO_3$ to a very great extent — a profuse growth of staphylococci being obtained even after 3 hours. However, even in serum, silver nitrat does as well as argyrol, and it must again be remembered that $AgNO_3$ dropped into the conjunctival sac has a chance to act before being inactivated.

Thus far, it is evident that, $AgNO_3$ protargol, and argyrol, in order named have a strong bactericidal action on staphylococci, where the organisms are unclumped and in even suspension. Now the vital question arises of—"How does this apply to clinical conditions," for obviously the above is not the case in acute conjunctivitis with exudation of pus, serum, and fibrin. Therefore, a quantity of pus, containing many staphylococci aurei, was obtained from an acutely inflamed axillary abscess, equal quantities of this material were placed in small bottles containing various strength solutions of argyrol, protargol, and $AgNO_3$, the mixtures vigorously shaken up, and cultures taken at stated intervals.

The results are shown in the following table:—

ACTION OF GERMICIDES ON PUS

SERIES III

TABLE G.

Time	1% Protargol	4% Protargol	25% Argyrol	1% Argyrol	1% Ag No. 3
15 min.....	*P/P	P/P	P/P	P/P	P/O
1 hr.....	P/P	P/P	P/P	P/P	P/O
15 hrs.....	P/P	P/P	P/P	P/P	O/O
24 hrs.....	P/P	P/P	P/P	P/P	O/O
60 hrs.....	P/P	P/P	P/P	P/P	O/O
96 hrs.....			12/12		

*Experiments—Run in duplicate.
P—Profuse growth.
O—No growth.

Another interesting fact noted in these experiments was that after 24 hours exposure, the 1% and 4% protargol and 1% argyrol began to precipitate out, or go into some chemical combination with the pus, with the result that the supernatant fluid became clear and lost its color—in other words pus destroyed the bactericidal power. This was not so in the case of 25% argyrol, which remained visibly unchanged. On drawing off the supernatant fluid, which was found to be sterile, and inoculating it with a suspension

of staphylococcus, a diminution in growth was noted in 50 minutes, which showed that pus had not been able to inactivate the 25% argyrol. It is also to be noted, that after 96 hours 25% argyrol acting on staphylococcus aureus in pus caused a diminution in growth (12 colonies). Thus to summarize briefly, of the three germicides acting on pus, $AgNO_3$ was the only one that seemed able to kill the organisms in pus, within a reasonable length of time, and in some cases took 15 hours to accomplish the desired result.

Finally in drawing my conclusions, it seems most feasible to group them roughly under two headings:—the laboratory and the clinical.

From a laboratory point of view, the following facts can be stated:

1. Argyrol is not inert and has a definite germicidal power, which, however, is not as great as that of protargol and silver nitrat. A large number of organisms are killed by argyrol in 30 seconds to a minute.

2. The conflict of the findings of Verhoff and Derby with those of Lancaster is easily explained by the variation of the number of staphylococci used per unit volume of germicide. The former workers used so many organisms, that their controls showed such a profuse growth that no separate colonies were discernible, while the latter used so few that some of his controls showed only fifty colonies. It must be emphasized again that the number of organisms used is a most vital factor in the results obtained.

3. In vitro 4% protargol is more efficient than 1% protargol, while 25% argyrol is no more efficient than 1% argyrol. This latter statement does not hold when acting on staphylococci in pus, where the 1% argyrol is, in time, inactivated.

4. The killing of organisms is a gradually shading off process. Dr. Verhoeff found that this was true of ultraviolet light, heat, and all chemicals.

5. For obvious reasons, the carbolic acid coefficient is not a practical standard for germicides which come in contact with living mucous membrane. A germicide powerful enough to kill all organisms in a period of minutes, would seriously damage the living tissue.

Now, what bearing have the above laboratory conclusions on the clinical aspect? A germicide is used, roughly speaking, for two purposes:

1. In the newborn as prophylaxis.

2. In the treatment of various types of conjunctivitis.*

In the prophylaxis of the newborn, two distinct factors enter in, mechanical cleansing, which is very important, and germicidal action. The condition in the newborn approaches laboratory conditions very closely, in that you have infected pus introduced into a normal conjunctival sac—which is more or less similar to pus in a test tube. Thus, judging from the experiments on pus, one is perfectly justified in saying that 1% $AgNO_3$ is greatly superior to either protargol or argyrol. There is one danger in the use of $AgNO_3$ and that is, occasionally a very strong solution of silver nitrat is employed by mistake and the infant's eyes are seriously damaged. Protargol is superior to argyrol and may be used in strength up to 20% without danger[9]. In short, argyrol is not the most efficient prophylactic in the newborn, and I do not believe it should be employed in preference to silver nitrat.

Now as to the severe, suppurative conjunctivitis cases. In these cases, microorganisms have entered into the tissues and are also in masses of purulent secretions. As is shown in Table G, the action of argyrol and protargol is practically nil on organisms in pus, and in this type of case the only organisms that can be killed are those which are unprotected on the surface—organisms which will probably be carried out of the conjunctival sac along with the mucopurulent discharge. Indeed the organisms which are doing the damage are probably those in the tissues, and it is not reasonable to expect to employ a germicide which will kill them. Any of the known germicides strong enough to kill these "protected

*In treatment of conjunctivitis, $AgNO_3$ is not considered as too irritating for continual use.

organisms" would certainly be strong enough to kill the tissue cells also. Obviously, the main part of the treatment of these cases is the mechanical cleansing by irrigation, altho the germicide may play a role in preventing reinfection. You sometimes see cases of ophthalmia neonatorum which hang on for months with a positive smear in spite of whatever form of treatment you employ—i.e.—I recently had a case at the Massachusetts Charitable Eye and Ear Infirmary which persisted for 6 months with a positive smear, in spite of all treatment with argyrol, protargol, zinc, etc. The organisms were evidently not reached by germicides. It is hard to see how, from a strictly germicidal point of view, argyrol can be of great benefit.

Another type of case to be considered is the ordinary mild acute or chronic conjunctivitis. Here laboratory evidence is only of slight value, for these conditions can certainly not be reproduced in vitro. What effect has argyrol and protargol in these cases? These can be no denying that they can kill a large number of organisms which are not clumped or in pus, within 30 seconds to 1 minute. (See tables E and F.) How great a percentage of the organisms in a mild conjunctivitis are in the above state, is merely a matter of simple conjecture. It would seem logical to suppose, however, that the causative organisms were deeper in the tissues, and not free on the surface of the conjunctiva, where argyrol could attack them. Perhaps the germicide plays a role in preventing reinfection, but this again cannot be proved one way or the other. There is another way of approaching the subject, namely:—

What happens in a conjunctivitis treated without displaying a germicidal drug? Take boric acid, for instance, which has negligible germicidal power. It is quite common to see a patient with a mild conjunctivitis who tells you of several previous attacks which cleared up with boric acid which he "bought at the drug store." Indeed, a very small percentage of these cases probably ever consult the doctor. They get well with mechanical cleansing. Theobald in 1880[10], when boric acid was being introduced into ophthalmology, wrote most glowingly of the new remedy and reported numerous satisfactory cures in conjunctivitis cases. He attributed this to the antiseptic and astringent value of boric acid. What role argyrol and protargol play in killing the organisms in these cases cannot be stated definitely, but I feel it must be rather slight, if any. At any rate, protargol is the more efficient.

In closing, there are several points which I wish to emphasize, especially in regard to my conclusions of a clinical nature.

In stating that argyrol has a definite germicidal power in vitro, I do not wish to give the impression of being an enthusiastic advocate of its use. Argyrol is a proprietary drug. Its continual use produces argyrosis. It does not keep well and it has little, if any, power of penetration, as shown by its failure to penetrate tissues and kill organisms in a corneal ulcer, or to kill organisms in pus. It is my impression that a large majority of the cases in which argyrol is employed by the general practitioner would do as well, if not better, under some such simple collyrium as zinc sulphat, as maintained by Theobald[11].

With the exception of silver nitrat, I believe that the germicidal action per se of the common drugs used in the conjunctival sac in inflammatory conditions, aside from perhaps having a role of preventing reinfections, is a relatively small factor. Mechanical cleansing, counterirritation, and detergent action are important factors to be considered.

Last of all, in regard to the value of drugs purely as germicides in the treatment of conjunctivitis, it is most important to remember that we have very little absolutely accurate e v i d e n c e either pro or con. The laboratory evidence is suggestive but not scientifically accurate, as it is not possible to reproduce such clinical conditions in the laboratory. On the other hand clinical evidence is wanting in that there are no controls. It would be

most instructive to take a large number of conjunctivitis cases, and have two series:—one treated with some of the germicidal collyrium and the other treated with, say normal saline irrigations. The latter series might show astonishing good results. In other words, it is a relatively simple matter to determine the germicidal power of a drug in vitro, but when you attempt to state of how much actual value as a germicide this same drug is in the conjunctival sac, in the absence of proper clinical controls, the conclusions must, of necessity, be more or less theoretic.

In conclusion, I wish to thank Dr. F. H. Verhoeff for his many valuable suggestions and the help which he has given me in preparing this paper.

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SEROUS TENONITIS.

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The case here reported from the Section on Ophthalmology of the Mayo Clinic is one in which corneal ulceration caused blindness and the removal of one eye. Thoro search failed to reveal any definite cause. But some light is thrown on what to avoid and the general line of treatment to be pursued. Read before the joint meeting of the Chicago Ophthalmological Society and the Chicago Oto-Laryngological Society, April 16, 1923. (See p. 693.)

Case A404122. A farmer, aged forty-seven years, came to the Clinic September 6, 1922 with a severe inflammation of both eyes. He had had transient attacks of "rheumatism," characterized by pain and tenderness around the elbows and shoulders, but had not been compelled to slight his work, or to seek medical assistance. He had never had any other disease of the eyes. He was a man of large frame, erect, muscular, and robust, usually weighing about 200 pounds. He was not unusually susceptible to colds, and as his work was mostly out-of-doors he was accustomed to exposure to rough weather.

In June, 1922, while engaged in driving a truck, he noticed a slight swelling of the eyes. This lasted a few days, then disappeared, but recurred for one or two days at intervals of two or three days. During the next three weeks, the intervals between attacks became shorter, and the swelling alternated, going from one eye to the other, gradually becoming more pronounced and more constantly present.

During July and August, there had been extreme swelling of the eyes, with considerable pain whenever he attempted to rotate them. For seven weeks before coming to the Clinic, he had been in a hospital, where cold packs had been applied to the eyes, and intravenous medication administered. The chemotic conjunctiva had been repeatedly stabbed, but no pus found. He had no symptoms aside from those directly concerned with the condition of the eyes, no headache or subjective noises, and his hearing was unimpaired.

On this patient's admission to the hospital at the Mayo Clinic, a thoro general examination was made, and his general condition was found to be quite satisfactory. The urine was nor-

mal, the hemoglobin was 70 per cent, the leucocytes numbered 9,900, the systolic blood pressure was 154, the diastolic 94, and the temperature 99.2 F. The eyes were tremendously swollen, the chemotic conjunctiva hanging over the cheeks. The upper lids were slightly edematous, but were loose and could be picked up, free from the globe. The lower lids could not be seen or felt, being entirely covered by the chemotic conjunctiva. The upper portions of the globes covered by the upper lids were not particularly chemotic, but were deeply congested with prominent blood vessels. The conjunctiva protruding between the lids was dark colored, smooth, dry, and firm. The globes were tender when pressed on, and could not be pressed back into the orbit, seeming to be held firmly as tho in a deep socket. The eyes could not be moved by voluntary effort or by external force, and all attempts to move them were accompanied by severe, deep pain. The conjunctiva of both eyes was reflected over the limbus below, and there was a large perforating ulcer of the right eye with vitreous and uveal tissue protruding thru the ulcer. The globe had not collapsed. On the left eye was an ulcer, 3 by 4 mm., in the lower part of the cornea, the upper part of the cornea remaining clear. The anterior chamber was shallow, the pupil was contracted, and did not react to light. The vision of the right eye was nil; of the left eye, ability to count fingers near the face.

The history obtained at the first examination was meager, because of the excitement and anxiety of the patient occasioned by his trip to the Clinic, and the circumstances under which he left the hospital where he had been under treatment. The only person who accompanied him had seen him during the illness only the day before, and so could give very little additional information as to the onset and course of the disease. It was quite evident, however, that the onset had not followed injury, or any known local or general disorder, and efforts were immediately made to determine the source of the inflammation. The ulcer of the right eye had perforated only a few days before, and the patient was certain that in the early part of the attack his vision was not impaired, except by the inability to open the lids widely. The absence of redness of the lids, the comparatively slight edema of the upper lids, absence of exudate on the conjunctiva, and clearness of the media of the left eye, together with absence of fever and leucocytosis were noted as against the diagnosis of panophthalmitis. The right eye, particularly, had no signs of secondary infection; no pus came from the interior of the eye; and in spite of the frequent stabs into the conjunctiva, no deep infection was present. There was no swelling of the preauricular, or cervical lymph glands. Careful rhinoscopic examination failed to show any disease of the paranasal sinuses, and examination of the throat and teeth was reported negative.

There was little to support a diagnosis of cavernous sinus thrombosis, and a tentative diagnosis of serous tenonitis was made. The most urgent need was to prevent the progress of the corneal ulcer in the left eye, and to reduce the chemosis of that eye as soon as possible, for it was believed that the ulcer was due to the effect of this chemosis. One per cent solution of mercurochrome was dropped on the cornea every hour, atropin solution every two hours, and the conjunctiva was covered with liquid vaselin. Hot compresses were applied twice daliy. Five injections of 3 to 5 c.c. of whole milk were given deep into the gluteal muscles, at intervals of forty-eight hours, but only a very slight general reaction was produced. The chemosis did not recede, and the ulcer showed no signs of healing. Administration of milk was then discontinued, and pilocarpin sweats given every other day; 50 gr. of sodium salicylat were given daily. After three weeks of this treatment, leeches were applied to both temples daily for four days. The feeling of pressure and deep tenderness now began to disappear and the ulcer of the left cornea healed.

Mercurial inunctions were applied to the temples, and the salicylates were increased to 60 gr. daily. The chemosis gradually decreased, ability to move the globes was gradually developed, but the right eye became more painful, and was removed under general anesthesia.

At operation, the conjunctiva below the cornea was found to be very much thickened. The capsule of Tenon was particularly thick, hard, and tough as sclera, and was connected to the walls of the orbit by dense bands. The capsule was not tightly adherent to the globe, and there was little hemorrhage following the enucleation. A section of the capsule was removed for microscopic study.

Microscopic sections of the right eye were misshapen and shrunken because of the collapsed condition of the globe, due to the perforating ulcer. The ulcer had practically destroyed the cornea, and in the anterior portion of the globe were acute inflammatory and destructive changes. The posterior structures of the globe were not involved in this secondary process. The vessels of the posterior third of the choroid were markedly dilated, and this dilation increased toward the disc; the retinal vessels were full, and those of the sclera dilated. This feature was also very conspicuous in the subconjunctival tissue; in fact vascular engorgement seemed to be the outstanding feature. The bit of Tenon's capsule excised and examined microscopically was greatly thickened; it was three or four times as thick as a specimen taken from a case in which the orbit was exenterated for epithelioma of the lids, and the connective tissue fibers were more dense and compact. There were numerous young fibroblasts; large, thin walled, apparently newly formed vessels; a diffuse, but patchy infiltration of leucocytes, largely polymorphonuclear; and in some places, considerable fibrin. A piece of an extraocular muscle was included in the section; the fiber bundles were widely separated as tho by edema; and marked degenerative changes were evidenced by great irregularity in staining and loss of striation.

The left eye continued slowly to improve, but the great thickness of the conjunctiva after all chemosis had disappeared was annoying, because of projection between the lids, and some was cut away. Low grade plastic iritis was present during the last four months of the period of inflammation, resulting in a small adherent pupil with some pigment and a thin membrane over the pupil. Seven months after the onset of the disease, the left eye was free from inflammation, with vision 6/20; the right eye had been lost from secondary causes.

DISCUSSION.

Etiology and pathology—Primary serous tenonitis is usually described in textbooks as an inflammation of the capsule of Tenon, characterized by a slight swelling of the lids, chemosis of the bulbar conjunctiva, slight proptosis, limited motility of the eyes, pain on the slightest movement, but without constitutional disturbance, such as fever and increase in leucocytes. That it is rarely encountered may be judged from the fact that Duane gives the description of a single case described by Fuchs, and that Pincus in 1915 stated that Birch-Hirschfeld had collected but forty cases, of which some were probably not cases of true primary serous tenonitis. Only a few cases can be found recorded in the literature since 1915.

The etiology of the condition is generally conceded to be concerned with rheumatism, gout, and exposure. Organisms have not been found in the tissue, or in the serous exudate, except in cases following injury to the anterior segments of capsule, such as operations for squint, entrance of foreign bodies, or in those cases associated with orbital cellulitis or orbital abscess. The onset of the disease is rapid. The first symptom to be noted is transient edema of the bulbar conjunctiva, and slight pain on extreme rotation of the eyeball. In mild cases the edema may last for a day or two, disappear, and recur for an equal length of time at intervals of two or three days. Frequently the edema and

pain alternate from one to the other eye, but seldom remain unilateral. In more protracted cases the intervals between attacks of pain and edema become shorter, and finally there is a tremendous chemosis in both eyes, and fixation of the eyeballs. Plastic iritis usually accompanies tenonitis in the protracted cases. Many of the cases reported in literature occurred after exposure to cold wind while driving an automobile, and one author reports several cases in one family, intimating the contagious character of the disease.

Terson says that we find in tenonitis the characteristics of inflammation of synovial surfaces, and characterizes the inflammation as a tenosynovitis, inasmuch as the tendon sheaths of the rectus muscles, as well as the tendons themselves, are concerned in the inflammation. Other authors compare the tenonitis to inflammation of articular surfaces in other parts of the body, such as are found in arthritis, and the statement is often made that antirheumatic or antigout remedies are advisable therapeutic procedures.

Textbooks on ophthalmology state that the capsule is composed of a lymph sac, lined with endothelium, in which movements of the eyeball occur as a ball in a socket joint. The studies of Whitnall give us a new conception of Tenon's capsule, and the disease of the capsule must, therefore, be viewed in a new light. Whitnall describes the capsule of Tenon as "a thin envelope of connective and elastic tissue completely surrounding the eyeball, from the circumference of the cornea in front to the entrance of the optic nerve behind; it is so closely applied to the globe that, in sections of the orbital contents, it is not readily identified, but by pulling the structures apart, posteriorly a space between it and the globe, the episcleral space, can be formed. Careful scrutiny will show, however, that the interval is really occupied by a felting of extremely fine connective tissue, the tissue of Tenon, episcleral tissue or tunica adventitia, comparable to the arachnoidea of the brain, tho finer and denser. There is no sign of an endothelial lining, and the second or visceral layer of the capsule, as somtimes described (Schwalbe, Parsons), is merely that part of the adventitia which remains adherent to the sclera after separation of the capsule. The space, according to Charpy and Hesser, is neither a true serous, nor a formed lymph cavity, as described by some authors (Schwalbe). Leber (1876) also denies that it communicates with the perichoroidal space of the eyeball, or contains lymph. The eyeball can move within the capsule, the adventitia being lax enough to allow of slight excursions, but in wider movements both globe and capsule move together as a whole upon the bed of orbital fat, which is loosely connected to the capsule behind. It is obviously impossible for the eyeball to rotate freely within a socket that is fixed to and terminates at the circumference of its anterior sixth, that is, the cornea, as well as attached to the muscles at their point of entrance."

If this description is true, we can hardly conceive of tenonitis being an inflammation of a closed endothelial lined cavity, but rather an inflammation of a tissue which has free communication with contiguous structures. The microscopic appearance of a section of the capsule removed after a severe attack of inflammation bears out this idea.

Differential diagnosis.—Primary serous tenonitis may be confused with orbital cellulitis, orbital abscess, cavernous sinus thrombosis, panophthalmitis, and scleritis. The milder forms of the disease probably will not be diagnosed, and inasmuch as the attacks usually subside without having damaged the structures of the eye, the early recognition of the disease is not particularly important. The severe protracted cases, however, may be puzzling. The disease may be distinguished from orbital abscess by a fluctuating edema of the bulbar conjunctiva, lack of pain, except on attempts at movement, and the duration of the inflammation, the milder cases lasting from four to twenty days, and the protracted cases for several months. Orbital cellulitis is usually unilateral, while primary tenonitis is practically always bilateral. The absence of constitutional symptoms such as fever, malaise, headache, and absence of leucocytosis are also character-

istic of the latter. The maintenance of good vision and lack of inflammation within the globe in tenonitis distinguishes it from panophthalmitis. Episcleritis and scleritis are more often found to be unilateral, do not produce the extensive chemosis, and are accompanied by considerably more pain than is found in tenonitis. The scleritis is also more prone to attack the anterior half of the globe, while tenonitis is probably more evenly diffuse.

The statement of Terson, that the cardinal signs of tenonitis are inflammatory effusion behind the eye, and pain on ocular movement, do not serve sufficiently to distinguish the disease. While there may be some inflammatory effusion to account for the proptosis and chemosis, I believe that congestion of the tissues within the orbit has a great deal to do with producing the proptosis. No pocket of serous fluid can be found by exploring the orbit, and stabs into the swollen conjunctiva do not release serous fluid, but only blood.

Azzena gives, as cardinal symptoms, exophthalmos (not of a high degree), limited motility of the eye, and chemosis of the conjunctiva. Birch-Hirschfeld mentions the same triad: moderate exophthalmos, chemosis, and restricted motility of the eye with pain. In rheumatic tenonitis the fundus is negative, there is no high fever, and the vision remains good.

Certain chronic cases with exophthalmos of several months' duration must be differentiated from tumors, and also from syphilitic hyperplasia and orbital thrombosis without blindness (Terson). The disease is in many cases self limited, and usually subsides without any material damage to the eye. The vision usually is not affected, particularly if the iritis which may be accompanying the disease is well controlled. Great danger to sight from corneal ulcers must be combated by reducing the chemosis as rapidly as possible. Believing that the cause of the disease is to be found in rheumatism or gout, the treatment naturally has followed the lines of treatment for those conditions. Large doses of salicylate and colchicum have been advised, with moist warm compresses, foot baths, and pilocarpin sweats.

The case of primary serous tenonitis here reported shows the necessity of careful differential diagnosis, the futility of repeated stabs into the chemotic conjunctiva, the necessity for early precautions to prevent corneal complications, and the resistance which the disease offers to all proposed methods of treatment.

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EFFECT OF BLOOD TRANSFUSION ON THE RETINITIS OF PERNICIOUS ANEMIA.

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This paper is based on observation of the effect of blood transfusion in thirteen patients seen at the Mayo Clinic. Hemorrhage was not prevented or its absorption hastened, but retinal edema and the tendency to hemorrhage gradually decreased. Abstract of thesis submitted for degree of Master of Science in Ophthalmology from the University of Minnesota.

The retinitis of pernicious anemia consists of a pallor of the disc or of the whole retina, edema of the retina, hemorrhages which may be superficial or deep, exudates or plaques, and changes in the walls of the vessels. The most constant of these are pallor of the disc and retina, and edema. The hemorrhages, once they appear, do not remain indefinitely, but may become absorbed, and the retina remains free for some time, or besides the old hemorrhages, a new crop may appear.

The hemorrhages in the retina correspond to the hemorrhages found in other parts of the body in this disease, for example in the skin, spinal cord, brain, and serous membrane. Retinal hemorrhages have also been found in secondary anemia and chlorosis. Thus they alone are not of significant diagnostic importance. The typical hemorrhages of pernicious anemia have white centers surrounded by red halos. They may be either superficial, having a flame shaped appearance, due to location in the nerve fiber layer, or deep, being more rounded and with more regular edges. They may lie either in the neighborhood of the papilla, or in the periphery. Their size varies from the small punctate to the diameter of the disc, rarely exceeding this, altho Bondi claims to have found one three disc diameters in size. Pathologic anatomic researches have shown that the hemorrhages are limited as a rule to one thickness of the retina, usually the nerve fiber layer; less often they are in the outer molecular layer, and occasionally in the two granular layers.

The origin of retinal hemorrhages is apparently not uniform. The various stages in their development have been explained by the development of aneurysms in the small vessels, by diapedesis, and by rhexis. In a number of cases fatty degeneration has been found in the walls of small and medium sized vessels, and embolism of the retinal capillaries has been noted.

The bright center of single hemorrhages has been attributed to various causes: (1) an accumulation of white blood corpuscles outside the walls of the vessels, as a result of small aneurysms in the wall or in the lymph sheath of the vessels; many investigators, however, have not found these small aneurysms; (2) a regressive metamorphosis of these accumulated cells, combined with a change in the surrounding tissues, and (3) varicose hypertrophy of the nerve fibers; these areas may lie in the center of hemorrhages or be separate. Bettman found the varicose hypertrophy of the fibers and also collections of lymphoid cells surrounded by hemorrhages. He followed these varicosities thru from a first to a final stage with a deep staining nucleus in the varicose area, which may explain some of the difference in opinion. Colloid masses in the outer molecular layer, analogous to those found in cases of albuminuric retinitis, are also seen. The plaques occurring in pernicious anemia are distinguished from the cotton wool exudate of Bright's disease by their lack of luster and their more saturated gray color.

The retinal vessels, both arteries and veins, may be dilated and tortuous. In this case there is generally a marked retinal edema. The color of the vessels may be almost uniform, so that arteries are distinguished from veins with difficulty. As a rule, however, the arteries are much lighter in color and have a broader light reflex because of their flattened condition. In other cases the arteries may appear to be small with an increased light reflex. This is usually the case after the retinitis subsides. The

smaller vessels may show the small aneurysms described by some authors[2], [11]. Bettman and Bondi both emphasize the fact that the disease in the walls of the smaller and medium sized vessels is one of the causation factors in the retinitis. They found the walls of the vessels thickened and the lumen narrowed with proliferation of epithelium and collections of round cells in the walls. Immermann and Mackenzie assert that the hemorrhages are due to the fact that the blood does not contain enough oxygen, and therefore the capillary walls become diseased. Bettman brings all of the phenomena (edema, hemorrhages, and varicosities of the nerve fibers) into close relationship with disease of the walls of the vessels, and to such extent that the degree of the pathologic condition is dependent on the degree of change in the blood vessels. Ulrich, however, did not find these changes in the vessels. The amount of edema of the retina varies. There may be little or none, or a large amount extending out into the periphery of the retina. One observer even reported a detachment of the retina due to a serous exudate interposed between the retina and choroid.

REVIEW OF LITERATURE.

The occurrence of retinitis in cases of pernicious anemia was recognized shortly after Thomas Addison first described the disease in 1855. Biermer, in 1874, in the first German report of pernicious anemia, directed attention to retinitis as one of the important factors. Mackenzie, in 1884, remarked on the tendency in all anemias, but especially in pernicious anemia, to the development of retinal hemorrhages as soon as the hemoglobin falls below 50 per cent. The percentage of cases in which retinitis occurs varies according to the investigator, most of the early investigators finding it in all cases examined at the height of the disease. Later observers, however, say that it occurs in from 44 to 62 per cent of the cases. Woltman found that 63 per cent of 150 patients with pernicious anemia had retinitis; in 33 per cent the retinitis was of low grade, while in the remaining 30 per cent it was associated with hemorrhages. Biermer, Bramwell, Horner, Müller, and Quincke found retinal hemorrhages in almost all of the cases they investigated at the height of the disease.

A series of thirteen patients with pernicious anemia and retinitis, observed at the Mayo Clinic during a period of three months, were selected and studied for the effect of blood transfusion on the retinitis. The patients studied were examined ophthalmoscopically the evening before transfusion, and again within three to six hours after transfusion. Following this, ophthalmoscopic examinations were made at intervals of from twenty-four to forty-eight hours for as long as the patients remained in the hospital. Several of the patients left the hospital at the end of twenty-four hours following transfusion, and further study was impossible. All of the patients were examined with pupils dilated with 4 per cent cocain at each examination. The dilated pupils permitted examination of the retina as far as the extreme periphery, and an accurate estimation of edema and light reflex. Nine of the patients had retinitis with hemorrhages or exudates. The remaining four had pallor of the discs, but no hemorrhages or exudates.

DISCUSSION.

Early in this study it became evident that those patients in whom no hemorrhages were evident before the transfusion, did not develop them immediately after transfusion. Patients who had retinal edema generally had less edema from twenty-four to forty-eight hours after transfusion. One patient (Case A401357) who had moderate edema of the retina at the first examination did not show any change in the amount of edema for twelve days following the first transfusion. Another patient (Case A399786) had less edema of the retina two days after transfusion, and another patient (Case A404630) had less within one day. The retinal hemorrhages disappeared immediately following transfusion in only one case (Case A400266). Another patient (Case A402554), when seen at the office before entering the hospital, had many retinal hemorrhages with the central white spots typical of per-

nicious anemia, but when seen in the hospital five days later only one hemorrhage remained. He had not been transfused during this time.

Four of the patients (Cases A372040, A398071, A398146, A401357) had new hemorrhages from time to time, even while receiving transfusions, but there was evidence of absorption of the older hemorrhages. Two of the patients (Cases A372040, A401357) had fresh hemorrhages at the first examination immediately following transfusion. However, fresh hemorrhages were noted in the same patients at times remote from the immediate effects of transfusion. Some of these hemorrhages at first were deep and diffuse, then became more superficial, and developed the central white spot characteristic of pernicious anemia, while other deep hemorrhages went on to absorption without developing the white centers. The superficial flame shaped hemorrhages also occurred without white centers, or had the white centers when first seen. In certain instances the white areas, generally thought of as being located centrally in the hemorrhage, were located at its border with only a small margin of hemorrhage on one side, and as much as one disc diameter of hemorrhage on the other. The hemorrhages varied from the smallest visible spot to one and one-half disc diameters in size. In most instances the hemorrhages were near the larger retinal arteries; in one case they were in the area midway between the superior and inferior nasal arteries in both eyes.

The improvement in the blood picture following transfusion did not seem to affect the appearance of hemorrhages, since the patients with recurring hemorrhages also had improved blood pictures. One of the patients (Case A398071) with fresh retinal hemorrhages, notwithstanding an improved blood picture, died while the retinitis was under observation.

CONCLUSIONS.

1. Transfusion does not prevent the further occurrence of hemorrhages in the retina.
2. Transfusion does not cause the retinal hemorrhages to become absorbed any more rapidly.
3. The remote effect of the transfusion is a gradual lessening of the retinal edema and decreased tendency towards the formation of hemorrhages.
4. No change occurs in the retina as an immediate effect of transfusion.

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SURGICAL ANATOMY OF THE LACRIMAL SAC.

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This is here described for the purpose of facilitating operations on the sac. The anatomy of neighboring structures and their relations to the sac are given. Many suggestions are made to assist in the recognition of the different parts exposed in operation. Read before the Brooklyn Ophthalmological Society, March 15, 1923.

The extirpation of the lacrimal sac, one of the common operations in ophthalmic surgery, is viewed by many as a procedure often difficult of execution and not rarely resulting in complete failure. Professor Meller, in his excellent work, "Surgery of the Eye," states, "The proper resection of the lacrimal sac is one of the most difficult operations in ophthalmology". Failure may be attributed, in large measure, to insufficient familiarity on the part of the surgeon with the many minute anatomic details involved, particularly topographic relations. One may boldly assert that of all operations in ophthalmology, none is so dependent for success upon correct anatomic data as the operation of dacryocystectomy. The text in the books on anatomy and special surgery is hardly satisfactory, in that many essential facts are omitted, the description often lacks clarity and in some instances is actually misleading, and many important points receive only scant mention.

The fossa sacci lacrimalis, in which lies the lacrimal sac, is a depression situated in the lower 2/3 of the foremost part of the medial orbital wall. The fossa is formed by the union of the lacrimal groove of the nasal process of the maxilla with the similar groove of the os lacrimale. The maxillary and lacrimal bones participate in varying amounts in the formation of the fossa. There are exceptional cases were the fossa consists exclusively of maxilla; on the other hand, in many instances the major part is composed of the lacrimal bone. The line of junction of these two bones, the lacrimomaxillary suture, extends vertically across the fossa dividing it frequently into two almost equal parts. The fossa is bounded in front by the anterior lacrimal crest of the ascending process of the maxilla; behind, by the posterior lacrimal crest of the lacrimal bone. Above, it is limited by the internal angular process of the frontal; here it is shallow and inconspicuous, and gradually narrows as it approaches the dacryon.

The fossa deepens progressively in its course downward; so that below, where it is continued into the nasolacrimal canal, it is almost circular or oval, in cross section. The processus hamularis, which represents the lower pole of the posterior lacrimal crest, and articulates with the lacrimal notch on the orbital surface of the maxilla, attains at times considerable size; in which cases the lacrimal fossa is encroached upon, thus reducing it in its vertical direction and increasing, pari passu, the length of the nasolacrimal canal. The floor of the fossa does not, as a rule, correspond with the sagittal plane, but is tilted about 15 degrees forward.

The anterior lacrimal crest, an important landmark in ascertaining the position of the lacrimal sac, is unfortunately ill defined at its upper half, and rendered still more so by the fibers of the internal canthal ligament passing over and beyond it. The rest of this crest, however, is well developed, and can be readily felt, being a prolongation of the sharp inferior margin of the orbit, where an elevation is frequently present, the lacrimal tubercle, which in many instances is sufficiently prominent to be utilized in locating the lacrimal sac which lies above and behind it.

The posterior lacrimal crest, much more conspicuous than the anterior, is a thin ledge of bone overhanging the fossa. It is additionally accentuated by having attached to it the periorbita, as the latter divides into two layers to line and bridge the fossa. The portion of the fossa dorsal to the lacrimo-

maxillary suture is very frail, in harmony with the character of the lacrimal bone; while the anterior segment, belonging as it does to the nasal process of the maxilla, is more sturdy.

The upper half of the lacrimal fossa is separated from the nasal cavity by the intervention of one or more so-called lacrimoethmoidal cells—air spaces in whose formation there participate the lacrimal, ethmoidal, frontal, and, frequently, the ascending process of the maxilla; while below and nasally, it faces the middle meatus. Orbitally, i.e., laterally, it is in relation to the lacrimal sac.

It is necessary to bear in mind all of the preceding facts when performing a dacryocystorrhinostomy. The site of election, other things being equal, should be the infero-posterior quadrant of the fossa. The fossa varies greatly in different individuals, both in contour and its several dimensions. In an examination of about a hundred human skulls but little uniformity was found: some fossae were deep, others shallow; some were long, others short; some were broad, others contracted antero-posteriorly; and they differed appreciably in their other features. The most frequent shape of the fossa is that of a hollow hemiovoid; with the widest part, however, somewhat above the middle, and not at the upper extremity as usually pictured. The average length of the fossa is about 16 mm.; its breadth from 4-8 mm.; its depth 2 mm. In the female these figures are 1 mm. less. It is stated that the fossa is broader in the brachycephalic and narrower in the dolichocephalic.

The nasolacrimal canal, a little shorter, usually, than the fossa, is constructed of three bones. Laterally, it is defined by the lacrimal sulcus on the nasal surface of the body of the maxilla; which is a continuation of the sulcus of the same name in the fossa above and which exhibits an anterior and a posterior lip that form, in the majority of specimens, more than half the circumference of the canal. Medially, the canal is composed of the descending process of the lacrimal above, and of the inferior concha below.

The nasal ostium of the canal is in the roof of the inferior meatus, about 15 mm. behind the anterior extremity of the inferior concha. This aperture of the canal must not be confused with a similar aperture in the contained membranous duct, which latter may be several millimeters lower down, since the duct is often prolonged beneath the nasal mucous membrane for some distance after it leaves the canal.

The direction of the canal as given and illustrated in the books is that of a line pointing downward and slightly backward and outward, i.e., diverging below, and if continued upward would intersect its fellow in the vicinity of the glabella. The ophthalmologist, in sounding the nasal duct, often notices that the upper end of the probe does not incline medially but is actually lateral or assumes any of several positions. This does not mean that the probe is outside of the canal (assuming the technic to be correct), but that the canal does not take the stereotyped direction as indicated in the books.

The lacrimal sac, delicate and frail in structure, fills the whole of the lacrimal fossa, and is molded to conform to the shape of the latter. Since the fossa shows much individual variation, the sac contained therein, will vary in a like manner. The continuation of the sac in the nose is called the nasolacrimal duct, altho, anatomically, there is no evident line of demarcation. The upper part of the sac is flat, while below as it nears the duct it becomes rounded. The sac is usually depicted as expanded above and narrowed into a cylindrical tube further down. In numerous dissections, I have found the socalled cupola of the sac triangular in outline, with its upper pole pointed and its surfaces but little curved.

The sac is often of irregular contour and rarely exhibits the trim figure shown in the text books. The sac is distinctly less wide in front than behind, in harmony with the prominence of the anterior and posterior lacrimal

crests respectively. In fact, the sac may present anteriorly a margin instead of a wall, especially in its upper part; more so, in those instances where the anterior lacrimal crest is poorly developed. In the new born, the sac and duct form a single elongated tube, of about equal diameter thruout; so that division into sac and duct is purely artificial, the latter being merely the lower half of the whole membranous passage.

The sac may be pictured as snugly secured in a space bounded by the fossa fascia, so that its superior margin, espein front, and laterally by the firm and tense fascia lacrimalis stretching from crest to crest. The sac is about 12 mm. long, 4-8 mm. broad, and 2 mm. in its horizontal width. The widest part is, as the rule, a few mm. from its apex. Except when distended by tears or pathologic fluid, the walls of the sac are in apposition. The sac is, therefore, a potential rather than actual cavity.

The sac wall is constituted of a thin, fibroelastic layer, lined by delicate mucous membrane; and is consequently readily ruptured during its dissection from the surrounding parts, especially when extensively diseased. In the cadaver, the sac, being in a state of decomposition, gives an exaggerated impression of its friableness, and is separated with difficulty from its periosteal bed. In the living the sac appears to be more deeply situated than it really is, owing to the relative obscureness of its anterior wall and the interposition of much soft tissue.

The nasolacrimal duct, resembling in structure the sac, except that its walls are more intimately connected with the subjacent periosteum, and its mucous membrane thicker and more vascular, is a little longer than the sac; and is continued for several millimeters beneath the nasal mucosa after leaving its osseous channel.

The lacrimal canaliculi are two narrow tubes about 10 mm. in length, each extending from the corresponding punctum lacrimale; and, directed medially and converging slightly, they enter the sac on its lateral aspect about 4 mm. below the summit, either separately or, more commonly, as a single joint canal. The outer 2/3 of the canaliculi lie in the posterior lip of the lacrimal portion of the border of each lid, surrounded by the fibers of the pars lacrimalis of the orbicularis palpebrarum muscle.

The tendo oculi, or internal canthal ligament, built of strong, closely knit connective tissue, bears important relations to the lacrimal sac; hence the necessity to the surgeon of having a clear understanding of the several features of this structure. The tendo oculi resembles in form the letter Y, placed horizontally; the two arms of the letter being the continuation of the medial ends of the upper and lower tarsal plates, respectively. The straight limb of the Y, which is broad, is inserted into the upper half of the anterior lacrimal crest, whence it spreads out, fan like, to a varying extent upon the frontal process of the maxilla, and becomes lost in the adjacent periosteum. In some cases, the tendon is attached as far forward as the nasomaxillary suture. At the medial angle of the eye, it sends a reflection inward and backward, that is inserted into the posterior lacrimal crest. This band, very thin and recognized with difficulty, is firmly adherent to the anterior surface of Horner's muscle; and may be best described as its fascial layer.

Gray states that the tendo oculi is 4 mm. long and 2 mm. broad. The dimensions are not constant. Sometimes the tendon is very short and relatively broad; at other times it is long and slender. The average dimensions are twice those given above. At its attachment to the maxilla it may be as much as 9 mm. broad. It is often pictured in the books as a narrow horizontal line crossing the upper third of the lacrimal sac. This is certainly unusual. Such an appearance is simulated when the tendon, as the result of a marked inclination from above downward and forward, presents frontally almost as a line instead of a flat surface, i.e., the tendon now looks directly upward with its anterior surface, and forward with its lower border.

The lower border of the tendon is represented as being free. This, I believe, is incorrect. According to my observations, this border has two lips, an anterior and a posterior, the former, only, being free; the latter, having muscular fibers frequently attached to it. On several occasions, I have seen fibers of the orbicularis oculi springing from both lips. At its upper border, the tendon thins out and gradually merges in the underlying lacrimal fascia, so that its superior margin, especially mediad, can hardly be distinguished. The anterior surface of the tendon is covered by those fibers of the orbicular muscle that go to the upper lid, while the fibers in contact with the posterior surface are distributed to the lower lid.

The sac does not lie immediately under the tendon, as usually stated, i.e., the tendon is not in direct contact with the sac, nor can it be lifted up from the latter to admit the passing of an instrument between them. There intervene muscle tissue and the dense lacrimal fascia, all three structures being intimately bound together. The canaliculi, where they perforate the lacrimal fascia, as well as their inner third, are situated close behind the tendon.

In the operation for the removal of the lacrimal sac, the most important guide is *the lacrimal fascia;* wherefore, perfect familiarity with this structure is of the greatest assistance. The periosteum of the orbit is named the periorbita. At the posterior lacrimal crest, where it is strongly attached, the periorbita divides into two layers: one, quite delicate and of loose texture, goes to line the floor of the lacrimal fossa; the other, the lacrimal fascia proper, firm and tense, bridges the interval between the crests to disappear in the periosteum of the maxilla. The sac is thus completely surrounded by periosteum. In the upper aspect of the lacrimal fascia may be seen the apertures where the canaliculi pass thru.

A few words in regard to the pars lacrimalis of the *orbicularis oculi* muscle. This is a short thick muscle, having its origin from the upper part of the posterior lacrimal crest and from the lacrimal bone a little further back; and frequently, also, from the adjoining lacrimal fascia. At the medial angle of the eye, it divides into two slips that become incorporated in the pars tarsalis of the orbicular muscle. One must be careful not to injure this muscle during an operation, lest an annoying ectropion of the lower lid result.

The blood supply to the sac and its immediate neighborhood is derived from the dorsalis nasi, angular, and medial palpebral arteries (branches of the ophthalmic), and the infraorbital (branch of the internal maxillary). The angular is a sort of liaison channel, between the ophthamic and external maxillary. The dorsalis nasi and the angular supply chiefly the superficial parts in this region; the inferior palpebral branch of the medial palpebral and the infraorbital, being more deeply situated, are distributed to the sac and duct proper. A rich venous plexus invests both the sac and duct, particularly the latter. The blood is drained away by the angular vein and its anastomotic branch to the superior ophthalmic, as also by the inferior orbital veins.

The innervation to the sac is obtained thru the infratrochlear branch of the nasociliary nerve; which, in turn, is a branch of the ophthalmic division of the fifth. The lacrimal gland is stimulated thru the lacrimal nerve, also a branch of the ophthalmic. It is a well established fact that after a dacryocystectomy, the epiphora that was so troublesome before the operation, often disappears. This possibly may be explained by some physiologic interaction between the lacrimal and nasociliary nerves, branches of a common nerve trunk, the ophthalmic.

A thoro knowledge of the regional anatomy of the lacrimal sac is a sine qua non for a successful dacryocystectomy. The relations differ, depending upon whether we dissect above or below the lower border of the tendo oculi. *In making the incision* above, we meet, from before backward, the following tissues in their respective order: skin, superficial fascia; fibers of the orbicularis oculi, tendo oculi, again fibers of the

orbicular, lacrimal fascia, sac, again lacrimal fascia (its posterior attachment), reflected or dorsal limb of the tendo oculi, Horner's muscle, septum orbitale, medial check ligament, and finally orbital fat. Below the tendon, the tissues successively encountered are: skin, superficial fascia, fibers of the orbicular muscle, septum orbitale, lacrimal fascia, sac, again lacrimal fascia, and lastly orbital fat.

In the extirpation of the lacrimal sac, the chief *difficulties* that confront the surgeon are: (1) Locating the sac, and, as a corollary to this, isolating it from the contiguous tissues, be they normal or pathologic. (2) Hemorrhage, which may cause no end of annoyance by so obscuring the operative field that the surgeon loses his bearings. The skin incision should commence about 10 mm. above the internal palpebral commissure, and be directed downward and outward, slightly curved, to a little beyond the infero-medial angle of the orbital rim, closely hugging the anterior lacrimal crest. The crest is a continuation of the sharp and easily felt inferior margin of the orbit. Its upper part, however, frequently loses its identity in the adjacent smooth bone, so that it cannot be demarcated, and consequently can no longer serve as a guide. In these circumstances, it is helpful to remember that the crest is about 4 mm., on the average, medial to the canthus internus. It can be best mapped out by palpation with a probe or the finger tip.

The skin incision may be outlined by making several small superficial nicks with a sharp knife along the proposed route, for the skin in this location is mostly very lax and shows a tendency to pull away from the knife. It is desirable to place the incision as much as possible in the path of the upper part of the jugo-nasal fold so as to conceal better whatever scar may result. The length of the incision is about 30 mm., sufficiently long to allow for its contraction upon the insertion of the speculum, which obviously converts the incision from a line into a quadrangle. In undermining the skin for the introduction of the speculum, some difficulty may be experienced in the neighborhood of the lower half of the tendo oculi, where the skin is very delicate and consequently readily buttonholed, and also for a short distance below, where it is closely adherent to the underlying orbicular muscle.

The next step is to cut thru the superficial fascia, which in this region is very thin and easily overlooked. This incision should correspond in direction with the skin incision, i.e., along the anterior lacrimal crest. There is now danger of getting a smart hemorrhage, if the surgeon is not cautious and fails to bear clearly in mind the local blood distribution. The angular vein lies directly underneath this fascia, being covered only by the most superficial fibers of the orbicular muscle.

Bleeding from this vessel may be avoided by keeping the proper distance from the nasal midline, for the vein is about 8 mm. mediad to the inner canthus, and the artery is still further away. If the surgeon cuts too high, he may wound the anastomotic branch to the ophthalmic vein, which lies between the upper border of the tendo oculi and the trochlea. By considering these relations, and making the incision neither too high nor too mediad, one escapes any serious hemorrhage at this stage of the operation. Not rarely, however, the blood vessels take an anomalous course, hence the surgeon should always be on his guard. The angular artery may not be the continuation of the dorsalis nasi, but be an independent vessel simply the terminus of the lateral nasal branch of the external maxillary. Sometimes a branch is given off from the dorsalis nasi that runs parallel and lateral to it. In one of my dissections, there were a medial and a lateral frontal artery which formed a union just above the tendo oculi. In the two latter cases, goodly sized arteries would have been divided during the operation with resulting troublesome bleeding. In another instance, the dorsalis nasi artery instead of perforating the septum orbitale and the orbicularis oculi in the usual situation,

penetrated the lacrimal fascia at the posterior lacrimal crest, took a winding course along the dome of the sac, and then passing thru the anterior attachment of the fascia, pursued its customary direction by the side of the nose to become continuous with the angular artery.

After the skin and superficial fascia are cut thru, there appear the fibers of the orbicularis palpebrarum and the inferior margin, only, of the tendo oculi. The usual statement in the books is that the tendo oculi is now exposed. This is only a partial truth, for the tendon, with the exception of its lower border, is almost wholly hidden by muscle. The muscle fibers below the tendon are incised close to the anterior lacrimal crest, and there comes into view a dense fibrous membrane, the *lacrimal fascia.* Once this fascia is recognized, the rest of the operation is comparatively easy. This fascia must not be mistaken for the lacrimal sac which is of a delicate blue color and more deeply situated. The fascia is incised slightly wide of the anterior lacrimal crest and from the lower border of the tendon as far as the ostium orbitale of the nasolacrimal canal.

The pale bluish wall of the lacrimal sac is now revealed. The temporal lip of the incised fascia is grasped with a small mouse tooth forceps and the outer side of the sac freed by blunt dissection. A convenient instrument for this is the blunt pointed tenotomy scissors. In separating the temporal lip of the incised lacrimal fascia from the sac, the surgeon must be careful not to split this fascia into layers (which may readily occur when this fascia is especially thick, as not infrequently happens). If the operator is unaware of this mishap, he will naturally be working outside of the sac, and will soon find to his chagrin that he has invaded the orbit, missing the sac completely. The tissues anterior to the upper part of the sac (orbicular fibers, tendo oculi, and lacrimal fascia), are now cut thru from before backward with a knife: or, if the surgeon prefers, he may introduce the posterior blade of a scissors between the sac and fascia and the other blade over the intervening tissue and thus cut thru. The lacrimal fascia beneath the tendo oculi, particularly high up, is appreciably reduced in thickness and can be scarcely differentiated.

The upper portion of the sac has now been exposed, and the canaliculi are cut across as close as possible to the lacrimal fascia. The sac is freed from the layer of fascia (periorbita) that lines the floor of the lacrimal fossa. The fascia is here much thinner than on the temporal side and is adherent to the sac wall. In many cases, in attempting to free the sac, the sac and fascia come away together, with the result that the fossa is denuded of its periosteum, or the lacrimal bone itself may be broken thru. In either event no apprehension need be felt.

The upper extremity of the sac which is fused with the lacrimal fascia is separated from the latter with several snips of the scissors. One should take care to avoid injuring, unnecessarily, the fascia, as it bleeds profusely and will obscure the depth of the operative field. Since the sac, during the operation, may be torn when grasped with forceps, being often friable as a result of disease, one can employ with advantage a piece of narrow tape (on the style of the umbilical tape found in the obstetrical packages), which is slipped underneath the sac in the form of a sling and used as a tractor. The sac now lies in its fossa completely disconnected, except for its attachment to the orbital ostium of the naso-lacrimal canal, where it is firmly united to the periosteum anteriorly. Using now the above mentioned tape as a ligature, the sac is tied rather low down, and pulling the latter up and outward, it is severed as far down in the canal as possible. This is best done with a knife cutting laterad from before backward. If the surgeon is not sure of his ground, he may cut mediad, to keep clear of the inferior oblique muscle which is often in close proximity. The nasolacrimal canal should be probed with the largest sound that can be inserted without injury to the bony structures, and the

mucous membrane curretted out with a sharp spoon.

I find that most of the bleeding comes from twigs of the infraorbital and inferior palpebral arteries, which are distributed chiefly to the lower part of the sac. This bleeding is often very disturbing. Bleeding from the venous plexus surrounding the sac can be avoided by respecting the integrity of the lacrimal fascia. The best way to control the hemorrhage is by pressure with cotton balls squeezed out in adrenalin chlorid. At times it is necessary to use mosquito clamps.

Before closing, I wish to criticise the frequently quoted statement that the tendo oculi serves as *the guide to the position of the lacrimal sac*. The most conspicuous part of the tendo oculi is at the anterior lacrimal crest and where it spreads out in front of it. If the surgeon cuts thru this part of the tendon, and he will do so almost instinctively, because his attention is attracted to it most, instead of locating the sac, he will strike bone, the nasal process of the maxilla. If he cuts the tendon too near the inner canthus, he will again be outside the sac, and will have injured Horner's muscle, and, perhaps find himself groping about in the orbital fat. The extent to which the horizontal width of the sac is covered by the tendon is almost negligible, with muscle fibers (sometimes called the anterior lacrimal muscle) and lacrimal fascia in between. Accordingly, if one makes his incision in the tendon to either side of a very small section, he will fail to encounter the sac altogether.

Much of the work embodied in this paper is based upon material freely put at my disposal by the Department of the Long Island College Hospital. I take this opportunity of expressing my sincere thanks to Professor Miller, Dean of the Faculty, for his many unfailing courtesies, and to Professor Evans for his invaluable aid so generously given on numerous occasions.

EFFECT OF INCREASE OF INTENSITY OF ILLUMINATION ON ACUITY, AND INTENSITY OF ILLUMINATION OF TEST CHARTS.

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The results of experiment with various intensities of illumination upon the normal eyes of four observers are here recorded in graphs and tables. The practical bearing of such variations in illumination of test charts is discussed.

Considered with reference to the eye, there are three factors in acuity or the power of the eye to see clearly,—the resolving power of the refracting media, the space discrimination of the retina and the sensitivity of the retina to light. To put it another way, there are the resolving power of the refracting media or the power to form clear images on the retina, and the resolving power of the retina or the power to discriminate detail in the physical image formed. The explanation of the effect of increase of intensity of light or the power to see clearly is to be found, of course, in terms of the resolving power of the retina, not of the refracting media. The purpose of this study has been in part to determine the effect of increase of intensity of illumination on the acuity of the normal eye, and to compare this effect with that obtained with the same eye made slightly defective as to refraction.

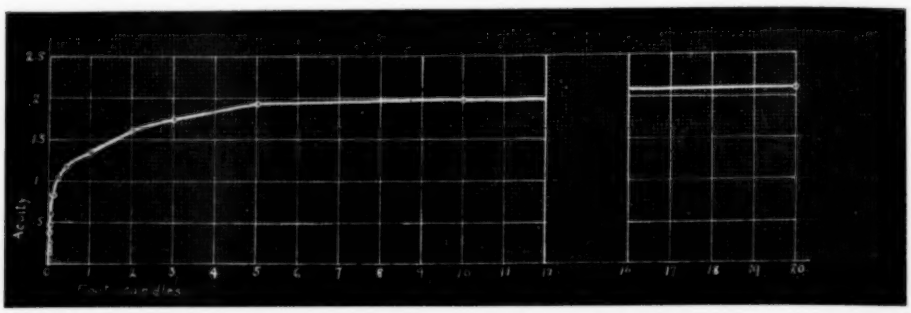

Fig. 1.—Effect of increase of intensity of light on acuity. (4 observers). Acuity plotted against foot-candles of light normal to surface of test object.

EFFECT ON ACUITY OF NORMAL EYE AND EYES SLIGHTLY AMETROPIC

In the series of experiments on the normal eye, four observers were used and the acuity was determined at 0.001, 0.005, 0.01, 0.015, 0.02, 0.05, 0.1, 0.2, 0.4, 1, 2, 3, 5, 10 and 20 foot-candles of light normal to the test object. The eye was adapted to each illumination by a thirty minute practice series with proper rest periods. The broken circle (the international test object) mounted on a rotating graduated dial was used as test object. In making the observation, all that was required of the observer was to indicate the direction in which the opening pointed. The judgment on which the estimate of acuity was based was thus reduced to very simple terms and an objective check was had on its correctness. In the final series of determinations this opening was turned in haphazard order right, left, up, down, and the four 45-degree positions; and a correct judgment was required in five out of the eight positions. The breadth of the opening was measured on a micrometer comparator and the visual angle computed. The coefficient of reflection of the test surface was 85 per cent. The preexposure and surrounding field were made in each case as nearly as possible of the same brightness as the test surface. An exposure of 1 second was allowed for each judgment. The work was done under artificial illumination, the light of frosted type B Mazda lamps. The angle of incidence of the light on the test surface was kept constant thruout the experiments.

Constancy of position of the observer's eye was secured by biting a mouth-board in which the impression of his teeth had been previously made, and hardened in wax.

From 0.001 to 0.1 foot-candle the minimum visual angle changed from 7.143 to 1.213 minutes, a gain of 489 per cent in acuity; from 0.1 to 1 foot-candle it changed from 1.213 to 0.714 minutes of arc, a gain of 63.7 per cent in acuity; from 1 to 5 foot-candles it changed from 0.741 to 0.516 minute of arc, a gain of 43.6 per cent in acuity; and from 5 to 20 foot-candles it changed from 0.516 to 0.477 minute, a gain of 8.2 per cent in acuity. A curve showing the average results for the four observers is given in Fig. 1. In the table of data for Fig. 1, it will be noted that an acuity of 1, 6/6 or 20/20 was attained at an illumination between 0.1 and 0.2 foot-candle; while at from 5 to 10 foot-candles, the range of intensity perhaps most frequently employed in office and clinic work, the acuity fell between 1.94 and 1.97.

In the experiments on eyes slightly defective as to refraction, the most practiced observer was selected from the former group, a comparison was made of the effect of change of intensity on this eye normal and made slightly astigmatic in the following

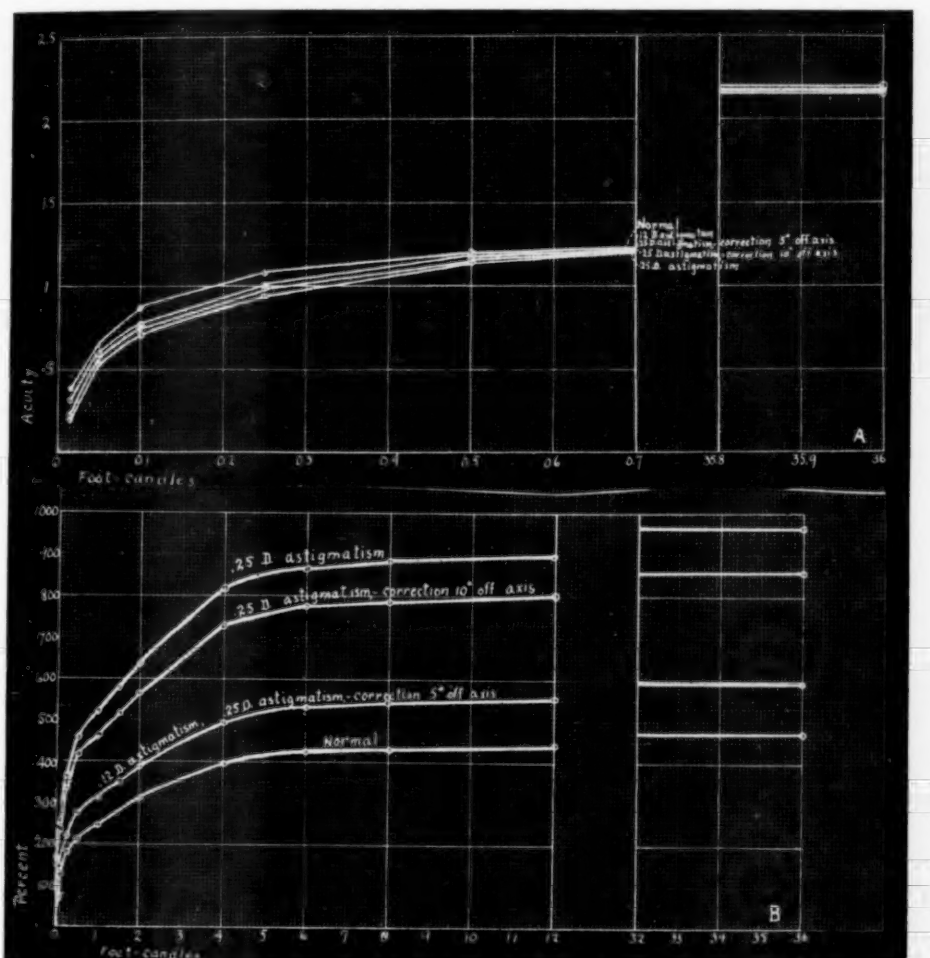

Fig. 2.—Effect of increase of intensity of light on acuity of eye with normal refraction and same eye made slightly astigmatic. A, acuity plotted against foot-candles; B, percentage gain in acuity plotted against foot-candles.

ways: by a +0.12 diopter cylinder; a +0.25 diopter cylinder; a +0.25 diopter cylinder with a correcting cylinder five degrees off axis; and a +0.25 diopter cylinder with a correcting cylinder ten degrees off axis. Artificial astigmatisms were chosen for this work, in order that we might know the exact amount and location of the defect and have a comparison of the effect on the same eye in the normal and defective condition. They were not chosen with the belief that they are the exact functional equivalent of the natural astigmatism. We are too strongly impressed with the possibility that the astigmatic eye may progressively acquire some power to compensate for this defect to be of this opinion.

The eye was presensitized by 30 minutes of adaptation to each illumination. The brightness of the preexposure and surrounding field was the same as that of the test surface. The coefficient of reflection of the test surface was 85 per cent. The intensities of illumination were 0.015, 0.05, 0.10, 0.25, 0.50, 1, 1.50, 2, 4, 6, 8, 12 and 36 foot-candles normal to the test surface. The results are shown in Fig. 2A and Fig. 2B. In Fig. 2A acuity is plotted against foot-candles, and in Fig. 2B percentage gain in acuity with increase of illumination is plotted against foot-candles. A point of particular significance to be noted in these data is that errors of refraction of these magnitudes give a scarcely detectable difference in acuity at the higher illuminations ordinarily used in the office and clinic; while at the lower illuminations, around 0.1 to 0.2 foot-candles, they give differences which are readily detectable. Among other things, these results indicate why eyes with uncorrected errors of refraction require more light as a comfortable working minimum than normal eyes, and why corrections apparently good enough for the higher illuminations are not good enough for work at the lower illuminations. They also raise an important question as to what is the most favorable intensity for the illumination of test charts.

INTENSITY OF ILLUMINATION OF TEST CHARTS

The question frequently comes before standardizing committees: At what intensity of illumination should acuity be tested? Our answer would be, it depends for what purpose the test is to be made. There are three obvious applications of acuity testing: vocational selection, diagnosis, and hygiene or welfare of the eye.

In the rating of eyes as to fitness for vocations, the test should be made as nearly as possible at the illumination usually employed in the vocation in question. The study of even a small number of cases shows that the eye can not be given the same relative rating as to acuity at different intensities of illumination. For example, experience has shown in the Navy that only 25-30 per cent of the men accepted for the service on the basis of the conventional acuity test at the higher illuminations are able to qualify for the lookout work at night on the bridge of the battleships. Further in a test of 61 observers made by us, all under 28 years of age and rating 6/4 acuity by the conventional test with 5 foot-candles of light on the test chart, 13 per cent rated below 6/6 at 0.55 foot-candle of light and 33 per cent below 6/6 at 0.2 foot-candle. The acuity of the remainder was 6/6 or better at these illuminations.

If speed in the use of the eye at low illumination be added to the requirement, the scatter is very much greater still. The amount of time required just to discriminate 1 min. of visual angle in this group of observers, who were all put in the same class by the acuity test at the high illumination, covered a range from slowest to fastest of 1333 per cent at 0.55 foot-candle and of 1443 per cent at 0.2 foot-candle. It is quite obvious that any attempt to rate eyes for vocational purposes at only one or even one order of intensity of illumination is based on a lack of knowledge of the differential effect for different eyes of intensity of illumination on the power of the eye to see clearly.

All will agree, we suppose, that the object in diagnosis is to give the test under the conditions providing the maximum sensitivity for detecting errors in refraction. A glance at the curves given in Figs. 2A and 2B is sufficient to show that this maximum degree of sensitivity is not obtained at the higher illuminations. For the small uncorrected astigmatic errors represented in these charts the difference in acuity is scarcely detectable at the higher illuminations, but readily detectable at the lower, particularly around 0.1—0.2 foot-candle of light. The reason for this is not hard to understand. The details in the slightly blurred astigmatic image can be discriminated at high illumination but not at low because of the beneficial effect of increase of intensity of illumination on resolving power of the retina.

This increase in diagnostic sensitivity with decrease of intensity of illumination was further directly tested out as follows: Low artificial astigmatisms were made and corrected. Starting with the proper placement of the correcting cylinder, the axis was shifted from its position by graded changes, ascending and descending series, until the judgment of just noticeable difference in the clearness of the letter B subtending a visual angle of 5 minutes was made. This was done at 15, 10, 5, 3, 0.46 and 0.25 foot-candles of light on the test card. The tests were made very carefully. Seven concordant judgments out of ten were accepted as the criterion of just noticeably difference in any one set of trials. The results are shown in Table I.

In any hygiene or welfare test of the favorableness of working conditions for the eye, the tests should also be made at more than one intensity of illumination. Conditions which are apparently acceptable at the higher illuminations are often far from equally acceptable at the lower illuminations. In all cases it will be found, too, that the sensitivity of the acuity test, whether the purpose be vocational, diagnostic or hygienic, is very greatly enhanced when the procedure is made to include speed, power to sustain, and accuracy, instead of accuracy alone as is the case in the conventional method of testing acuity.

TABLE I.

Showing number of degrees at which cylinder must be placed off axis to give just noticeable difference of clearness of test object. Results are based on 7 correct judgments out of 10.

Observer	Astigmatism	High Illumination (Average of results at 5 and 10 f.c)	Low Illumination (Average of results at 0.25 and 0.46 f.c)
H	0.25 cyl. ax. 90°	15.0	2.5
E	0.25 cyl. ax. 90°	13.5	5.0
L	0.25 cyl. ax. 180°	8.5	6.5
S	0.37 cyl. ax. 180°	13.5	4.0
C	0.50 cyl. ax. 90°	20.3	9.5
Bs	0.75 cyl. ax. 90°	9.0	5.0

VARIATIONS IN NORMAL VISUAL ACUITY IN RELATION TO THE RETINAL CONES.

ALFRED COWAN, M.D.

PHILADELPHIA.

A brief review of previous literature of this subject is given. It is assumed there is direct relation between the size of the smallest distinguishable image and the diameter of a foveal cone. The image must stretch across one cone onto those adjacent. A list of references is given.

Felix Plater (1536-1614) was perhaps the first to show that the "Chrystal" of the eye formed images on the retina, which he supposed were magnified. Our present knowledge of image formation, however, dates from 1610, when Johannes Kepler, in the "Dioptrics of the Eye" gave mathematic proof of the path of light rays in the eye and their focus on the retina. Later Scheiner performed his ingenious experiments, to prove that the retinal image is inverted[1].

Robert Hooke[2], whose posthumous works were published in 1705, proved by a series of experiments, that only the very best eye can distinguish a double star as such, when the distance between them subtends an angle at the eye of half a minute, and only one in a hundred can distinguish it when it subtends an angle of less than a minute.

This does not mean that even a *point* of light would not be *perceptible*. Thomas Young[3] tells us that a minute point assumes the shape of a star when beyond the furthest focal distance, and Donders[4] says: "To illuminated points on a dark ground there are scarcely boundaries. Small as such a point may be, its image has, on account of the imperfection of the dioptric system of the eye, a certain extent; and the question is now only whether this produces, on one or more percipient retinal elements, a difference (1/100 to 1/50) of illumination from the others, sufficient to be distinguished. ******* The question as to the smallest angle under which any object is still to be seen, is thus governed completely by the degree of illumination, and in a physiologic point of view it has therefore no meaning." In the words of Landolt[5]: "The determination of the acuteness of vision consists, therefore, in the determination of the smallest retinal image the form of which can be distinguished." Not the smallest image *perceived*, but the smallest whose form is *distinguished*.

Helmholtz[6] gives a complete bibliography on the subject of visual acuity, from Hooke down to his own time, and a description of his own experiments with gratings of black wire. Helmholtz's findings were nearly the same as those of Hooke.

The results of numerous experiments, by many investigators, over a long period of time, all agree that the smallest visual angle of distinct vision, is about one minute. Percival[7] gives the minimum angle for form sense as 53″ and says that for convenience it is assumed to be 1′.

The diameter of the cones at the fovea is given by Schäfer[8] as .002 mm. and Edridge-Green[9] gives the figure of M. Schulz as .0020 to .0025, H. Müller as .0015 to .0020, and Welcher .0031 to .0036; so that it may be said with Johnson[10], they vary between .0025 and .003 mm. in this region. The cones, which are the only elements at this place in the retina, are very close together, the space between, according to Parsons[11], being only .05 to .27 of their transverse diameter.

The size, on the retina of an emmetropic eye, of an image subtended by an angle of 1′ is about .004 mm. This is the size of the retinal image of the strokes of a standard 5′ test letter. If the test card used is constructed on a 4′ angle, the size of the retinal image of the stroke of such letter is very nearly .003 mm.[12]

If there is any relation between the size of the retinal image and the diameter of a foveal retinal cone, it appears that, in order for an object to be distinguished, the retinal image must be large enough to cover one cone and reach *onto* the adjacent ones on each side. Edridge-Green[13] maintains that the cones are indirectly stimu-

lated by a substance which sensitizes the fluid *around* them; and, in order for an image to be be distinguished, so he claims[9], at least one cone must intervene between those which are stimulated. In the face of the relationship between the size of the retinal image and the diameter of the cone, it seems that if the intervening space between and not the cone itself, were the percipient element, the smallest distinguishable retinal image would only need to be the width of a cone. This, if we accept some of the figures given, would be as low, in these cases, as .0015 mm., which would be very fine vision. Of course, allowance could be made by the contraction of the cones, which he says [14] takes place, but they must do so to a considerable extent. Even this is denied by Barraquer[15], who asserts that the cones *flatten* under the influence of light, and Schanz[16], that the cones are not percipient at all.

It is needless to say that a discussion of the merits or failings of the numerous theories of vision could lead to nothing but confusion. Almost anything may be claimed, even that the retinal image is erect and not inverted[17]; but this has been ably answered by Hartridge[18].

So much has been written on every phase of this subject that one hesitates to add, even a little more, to the great mass. It is, therefore, with trepidation, that an hypothesis is here presented to explain why, in two eyes, apparently alike, there should exist a marked difference in absolute visual acuity; i.e., one eye, perfectly healthy, emmetropic or made so, in an intelligent person, with vision less than 1 and another, tested under identical conditions, with vision well above 1.

For the theory here presented it is necessary to assume that:

1. The cones are the percipient elements and each has its own separate fiber.

2. There is a direct relationship between the size of the smallest distinguishable retinal image and the diameter of a foveal cone.

3. The smallest distinguishable object must be of such size, that its image will stretch across one cone and onto each adjacent cone.

The most sensitive portion of the retina is in the macula and it is here, as Southall[19] has said, that the resemblance between the retina and a photographic plate ceases, because the photographic plate is equally sensitive all over. Acuity of vision rapidly decreases toward the periphery of the retina, and as Tscherning[20] aptly puts it, "To judge of the form of objects we grope for them, so to speak, with the look." This we all know, and it is perhaps true to a greater extent than is usually suspected. It might seem that only the very smallest image is the distinct one and the one we seek. In closely studying an object, we survey the whole with a series of rapid glances, gradually concentrating on a smaller and still smaller area, until we find ourselves looking at a mere speck. It seems that, except for the spot fixed, all other parts of even very small objects, are seen indirectly. The reason for this is that a larger image impinges on elements which are not so sensitive as the central element, and Donders[21] assumes as correct "that the acuteness of vision is inversely proportional to the number of percipient retinal elements which are required, in a linear dimension, to the distinguishing of the image."

Since the macula is the most sensitive portion of the retina, the fovea is the most sensitive part of the macula, and the center of the fovea its most sensitive portion, does it seem unreasonable to presume that the most sensitive and most highly developed cone of the fovea should lie in its center? Having gone this far, we might go a bit further and suppose, that this very highly developed element of the fovea has its own most sensitive place; a place, which in the course of evolution, has developed within this cone, just as the cone itself has developed its highly complex function[22]. This place must be a point and it would therefore be the fixing point for the eye.

At first, this might seem far fetched, but there must be a point on the retina which fixes an object, and a cone, however small, is not a point. This fixing

point lies on the principal axis of the cone of light, which coincides with the visual line and is therefore the center of the retinal image.

If, in order that an object be distinguished, it must produce an image on the retina of such size that its edges impinge on two cones separated by a

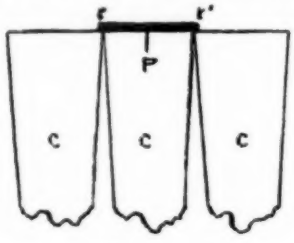

Fig. 1.

Fig. 1.—Diagram representing adjoining cones C C C. P, fixation point, rr' retinal image slightly larger than the cone.

third, the limit of visual acuity will depend on the position, in the central cone, of the fixing point. In the figures, ccc represents the cones, rr' the edges of the retinal image, and P, the fixing point. In Fig. 1, P is exactly in the center of the central cone and therefore in the position for the greatest acuity of vision. In this case P is an equal distance from r and r' and the image is only slightly larger than the cone. In Fig. 2, we have the other extreme. Here P is near one side of the cone, and since it must extend to r' to reach the next cone on one side, and P being the center, it must necessarily

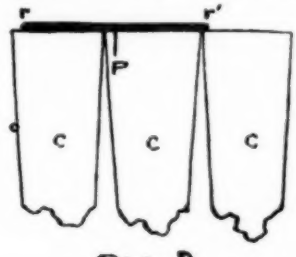

Fig. 2.

Fig. 2.—Retinal cones C C C, fixation point P. Retinal image rr' slightly smaller than two cones.

extend the same distance on the other side. Here the image would be nearly twice the size of that in Fig. 1.

The visual acuity would vary from the highest, in which the fixing point lies in the center of the central cone, to the lowest, in which the fixing point lies near the edge of the central cone.

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EYE SHIELD TO PREVENT DELIRIUM FOLLOWING SENILE CATARACT OPERATION.

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One of the most serious postoperative complications of senile cataract removal is the likelihood of delirium, or even temporary insanity. Cases of delirium following operation upon the eyes are not infrequently reported. As long ago as 1863, Sichel[1] described the delirium which he had observed a number of times in patients past the age of sixty as a sequel to cataract operation; and which he attributed to the fact that the eyes were kept closed, producing a mental state similar to nostalgia. Ten years later, Arlt[2], in giving directions concerning the removal of dressings in senile cataract treatment, stated that the unoperated eye should not be uncovered before the fourth day unless the patient became very uneasy by being kept so long in the dark, for "in old patients, much run down, timid and nervous, mental disturbances may occur during the first few days after the operation."

Discussion as to the causal factors of this mental disturbance has taken many different phases, but it is quite generally agreed, that when delirium complicates operation for senile cataract, the age of the patient and the effects of keeping him in darkness are the most important factors. Many years ago Krafft-Ebing suggested that the mental disturbance was the result of fright incident to the bandaging of the eyes, and Schmidt-Rimpler, another observer, reported two cases of delirium, where the patient had been kept in the dark, but no operation of any kind had been performed. One patient was a young man, suffering from double iridochoroiditis; the second, a case of syphilitic iritis, age not stated.

In 1913 Walter R. Parker of Detroit[3] reported eleven cases of dementia following operation for senile cataract, out of a total of 376 operations. The ages of the patients ranged from a woman of fifty-three to a man of eighty. "The psychoses began from twenty-four hours to six days after the bandages were applied. In five cases the delirium occurred during the day time, in six during the night, but in every case the symptoms were more prominent at night. After the operation the patients were quiet and tractable. Later they became restless, indifferent to precautions to remain quiet, often raised themselves without assistance, disturbed the bandages, etc. They usually answered questions rationally, but gave little heed to instructions. The majority were disoriented and hallucinations of hearing were more common than those of sight."

Four similar cases occurred in my practice within a period of three months. The gravity of such a condition, especially the danger of prolapse of the iris, or other injury to the operated eye while the patient is irrational, is fully appreciated by all ophthalmic surgeons; and any means by which this danger can be minimized, or wholly obviated will be welcomed by all who are called upon to do eye surgery.

The eye shield here illustrated is designed to permit the patient a certain amount of use of the unoperated eye, but at the same time to prevent strain upon the recently made wound by muscle action.

The shield is made for both the right and the left eyes, similar in size and shape to the well known Fox shield. but conforming more closely to the orbital area. It is made from solid stock aluminum; and has but one opening, located in the center, which I call the "peep hole." The peep hole is twenty mm. long and five mm. wide.

After the operation is concluded and the dressing has been applied in the operator's usual way, a shield is fastened over the dressing with adhesive strips, and acts as a protector to the operated eye. Over the unoperated eye a shield is fastened with adhesive strips (no dressing is used), care being

exercised to have the "peep hole" directly on a plane with and in front of the pupillary opening.

This peep hole shield presents numerous good points. As delirium frequently occurs when both eyes are bandaged, and this mental disturbance may even lead to insanity, or at least make the patient unruly, heretofore the best thing to do was to uncover the good eye and give him a chance to see that he is not totaly blinded. If covering both eyes causes delirium,

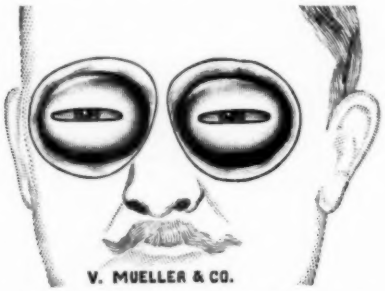

Fig. 1.—Eye shield of L. M. Gurley for use after cataract operation. The operated eye should have a dressing placed beneath it.

and uncovering the good eye relieves it, it is only logical reasoning to assume that if the patient could have seen daylight thru the peep hole from the first, the delirium would not have occurred. Since I have used the peep hole shield, no case of delirium has occurred in my practice.

If a patient lying in bed is approached or spoken to, he usually looks downward toward the speaker; if the sound eye is uncovered this may cause the recently agglutinated wound in the operated eye to be torn open, with a resulting prolapse of the iris. With the peep hole in position, there is no inclination to look downward but only directly forward. This looking directly forward does not encourage rotation of the eyeball, thereby permitting both eyes to rest quietly in their natural position.

When this shield is used the patient need not be kept so long in bed, as I usually allow them to sit up on the third day, and there is never any necessity for confinement to a dark room. The dressings are allowed to remain undisturbed for about five days.

After the shields are placed in position, a strip of adhesive can be placed over the peep hole for the first twelve hours, should the surgeon prefer that both eyes be closed temporarily. This strip of adhesive can be removed without interfering with the dressings.

I have used these shields for several years with great satisfaction in nearly a hundred cases. They are made for me by V. Mueller & Co., of Chicago, and were shown at the International Congress of Ophthalmology at Washington in 1922.

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NOTES, CASES, INSTRUMENTS

KNIFE BLADE IN THE ORBIT.

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The unusual condition of a knife blade remaining in the orbit for four and one-half months seems to justify a report of the following case:

On August 26, 1922, a messenger boy, aged 16 years, while in a fight was injured in the left temple. The boy's attention was attracted to his injury by some blood on the side of his face, which he believed to be coming from a scratch, and sought relief in a neighboring drug store. Under a bandage applied by the druggist the wound healed in a week. Outside of a slight dull pain in the eye the boy had no symptoms. A week after the injury he noticed that he could not see distinctly with the left eye, and that he could not move the eye as usual. He had formerly noticed no difference in the vision of the two eyes.

Four weeks after the injury he applied to the City Hospital for treatment. Examination of a rather small, frail boy, weighing 130 lbs., revealed a vertical scar in the left temple about 13 mm. long and 3 1/2 cm. from the outer canthus. There was a slight divergence of the left eye with some deviation upwards and an inability to move the eyeball inward beyond the median line and downwards. The pupil was moderately wide and responded to light. Fundus perhaps somewhat more pale than the one of the right eye; arteries and veins normal. There was no perception of light. The right had normal vision.

X-ray examination revealed a knife blade extending transversely across the orbit, evidently below the eyeball and running slightly forward from the point of entrance.

Fig. 1.—X-ray picture from front showing knife blade in orbit.

The boy refused an operation. He was not seen again until Jan. 10th, 1923, four and a half months after the injury, when, on account of some pain in the left eye, he returned reconciled to the operation. The eyeball was still deviated upward and outward, but motility in the opposite direction had returned. The fundus was unchanged, except that there was a beginning atrophy of the nerve. Arteries and veins were apparently normal. Vision = 0.

Under general anesthesia a large incision was made over the left temple down to the temporal fascia, as is employed in the Kroenlein operation. The temporal and masseter muscles were divided at their attachment to the external angular process and the malar bone and the muscle tissue rolled back. About 1 1/2 cm. from the bony edge the end of the foreign body was exposed. It was fimly held in the bone and only a narrow piece was protrud-

ing. This was grasped with a pair of automobile pliers and was readily removed after loosening it with a twisting motion. It was an old rusty knife blade, almost 4 cm. long and 13 mm. wide. There was no reaction in the eye or orbit following the operation, and the wound healed without incident.

Fig. 2.—X-ray picture from side showing relation of blade to cranial bones.

The presence of a large foreign body transfixing the orbit with symptoms so slight that the patient did not suspect its presence is unusual—in fact almost inconceivable. The absence of suppuration in the presence of a dirty, rusty piece of steel is also noteworthy. However, the feature of greatest scientific interest in this case is the rapid loss of vision in the absence of any pathology to account for it. With a normal fundus the assumption that the blindness was caused by an injury to the optic nerve behind the entrance of the arteria centralis retinae, which usually perforates the nerve sheath 10 to 15 mm. behind the eye, seems justifiable, yet the forward position of the knife blade would preclude such a possibility. The blindness and also the paralysis of the extrinsic ocular muscles can perhaps only be explained as resulting from the pressure of a blood clot which formed rapidly at the time of the injury.

DACRYOADENITIS FOLLOWING BRONCHOPNEUMONIA.

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It may be observed, that affections of the lacrimal glands are as infrequent as those of the lacrimal sac and duct are common. The position of the lacrimal gland gives it the fullest measure of protection, and its numerous ducts emptying downward render infection from the conjunctiva less easy. Therefore, it has been observed that infections of the lacrimal gland are usually endogenous rather than ectogenous.

Examination of the literature of dacryoadenitis reveals its infrequency; this applies particularly to bilateral involvement. It is, indeed a rara avis of ophthalmic practice. The case I am reporting is the first that I have met with in my practice. Arlt in his "Lehrbuch" says that he had never seen a case of dacryoadenitis, and Hirschberg (Arch. of Ophth. Vol. 8, p. 369) states that among 22,500 recorded cases of eye disease, there was but one of suppuration of this gland. In 1886 Powers stated that one case of an abscess of this gland was mentioned in the Royal London Ophthalmic Reports. It is well to note that Cowper in Vol. 5 No. 2 of the Am. Jour. of Ophthal. re-

ports a case of "Symmetric Cystic Enlargement of the Lacrimal Glands Due to Syphilis." There was no pain or discomfort, and tenderness or redness were absent. Three or four weeks after one injection of arsphenamin the swelling entirely disappeared. In the case I am reporting there were no symptoms of inflammatory reaction, simply marked swelling under the external angular process of each eye. The bacteriologic examination was negative, simply revealing a few streptococcus albus and xerosis bacilli.

Fig. 1.—Bilateral symmetric dacryoadenitis.

The patient consulted me February 16, 1923, and gave the following history: About five weeks previous to this date the family had been driven out of the house by fire. The weather was cold, and the patient in making the necessarily hasty escape was insufficiently clad. There was probably some irritation from smoke. As the result of these causes she developed a low grade bronchical pneumonia. Her physician informs me it was mild in degree, and her temperature did not go above 102. He saw the patient but twice, and she was confined to her bed for two weeks only. At about the time of her recovery, a swelling developed symmetrically, involving about the outer halves of each upper lid. She did not come to see me for at least ten days after the appearance of this swelling. She stated that the appearance was very much the same as at the beginning, except not quite so noticeable. She had experienced no pain and had had no discharge from the conjunctivae. She said there had also been an entire absence of any redness or discoloration of the skin over the area of swelling.

Inspection revealed a bilateral and symmetric swelling situated in the region anterior to each lacrimal gland This was of quite noticeable degree but without change of color of the skin The outer third of each palpebra fissure was narrowed and the sulci between the lids and eyebrows was obliterated in the outer half of each lid. There was no dilation of the conjunctival vessels, and eversion of the lids showed no involvement of the accessory glands. There was a normal amount of lacrimal secretion, and the patient told me she had experienced no pain. There was no involvement of the parotid or sublingual glands. Pupils were normal in appearance and reaction. The excursions of the eye were normal.

Upon palpation of the swollen areas, involvement of the lacrimal glands was indicated by doughy masses projecting from under the orbital ring in the region of the lacrimal fossae. There was no tenderness experienced by the patient during this procedure. There were no signs of a synchronous involvement of the glands of Krause. The upper portions of the tarsal conjunctivae and the fornices appeared normal. The tissues of the lid did not seem to be involved, and it was clearly an involvement of the lacrimal glands alone.

It is to be recalled that in the peculiar syndrome called Mikulicz' disease, we have symmetric involvement of the glands of the head including the lacrimal glands. One such case reported by Carl Fisher, of the Mayo Clinic, some years ago, before the Minnesota Academy of Ophthalmology, forms the only exception to the previous statement regarding my

experience with bilateral involvement of the lacrimal gland. Dewatripont, in La Clinique Belge of Oct. 28, 1911, reports four cases of suppurative inflammation (monolateral), in which the only organism was the pneumococcus. He states that after the phlegmonous inflammation set in, this organism was replaced by the streptococcus, and that these four cases arose from nasal origin.

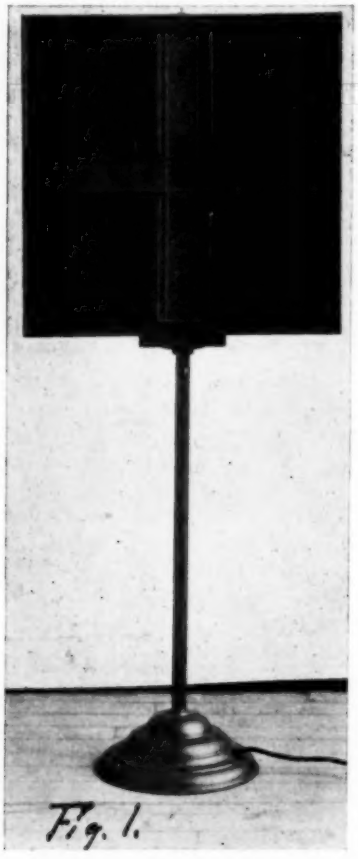

Fig. 1.—Phoria indicator on black cabinet.

Fig. 2.—Reverse of cabinet showing astigmatic chart.

HETEROPHORIA AND ASTIGMATISM CHARTS.

L. Webster Fox, M.D., LL.D.

PHILADELPHIA.

There is nothing new or novel in this combination phoria chart with astigmatic chart. It does, however, make a most useful and attractive addition to the paraphernalia of the ophthalmic surgeon's consulting room.

This Prentice Phoria indicator (Fig. 1.) is placed flush with the front surface of lid on a black cabinet. The cabinet is vertically positioned on a telescoping rod with base. This telescoping feature permits the operator to raise and lower the apparatus to a point exactly on a level with the patient's eyes. The discs of light are arranged like a Greek Cross with the central light red, and from it radiating vertically and horizontally, one degree prism angle apart, are green lights, five-eighths of an inch in diameter. These discs of light are controlled by a switch at the examiner's table. When great accuracy is required, a Maddox Rod is placed before one eye, and at once the phoria defect is ascertained.

On the reverse side of this cabinet (Fig. 2.) we have placed an astigmatic

chart, which I have used for many years and found most valuable. This chart is readily brought in position by simply rotating the cabinet on its base.

All ophthalmic subjective tests must be adapted to the meanest intellect. In other words, a test which may be simplicity itself to the oculist, is, apparently, most complex to the patient. The successful ophthalmic surgeon is the one who can make the "dullest wit" appreciate these small differences and give answer to correlative questions.

Having made many experiments with the various astigmatic cards in use, I have taken the best among many of those giving the most satisfactory results. The figure above explains itself. The dullest circle at the periphery of the finer radiating lines in this card is colored red, which adds materially in concentrating the attention of patients to the inner circle, and if astigmatism exists, the meridian is ascertained.

I am indebted to Messrs. Wall & Ochs, Philadelphia, for constructing the cabinet and stand described in this paper.

METER MEASURE FOR RETINOSCOPY.

WILLIAM W. GOLDNAMER, M.D.

CHICAGO, ILL.

The meter rule here illustrated, is offered to the profession, hoping that it may be of value to those ophthalmologists who are striving for accuracy in the department of retinscopy.

The different relational sizes or builds of the patients and operators, or the shrinking nature, of visa versa, of nervous individuals, often renders it quite difficult, in the dark room, to judge accurately the distance desired, or used, in retinoscopy.

We all recognize that an error as to distance of 4 cm., makes a difference of practical importance in our findings.

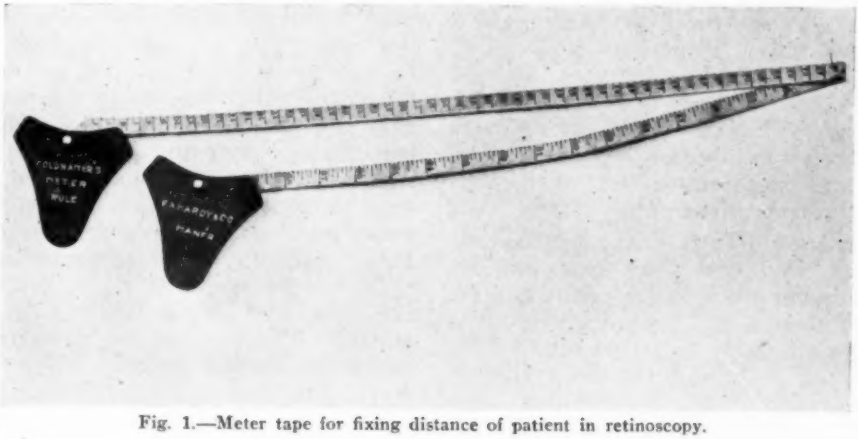

Fig. 1.—Meter tape for fixing distance of patient in retinoscopy.

Fig. 2.—Method of using meter tape by holding chin rests to patient and observer.

SOCIETY PROCEEDINGS

Reports for this department should be sent at the earliest date practicable to Dr. Harry S. Gradle, 22 E. Washington St., Chicago, Illinois. These reports should present briefly scientific papers and discussions, include date of the meeting and should be signed by the Reporter or Secretary. Complete papers should not be included in such reports; but should be promptly sent to the Editor, as read before the Society.

COLORADO OPHTHALMOLOGICAL SOCIETY.

March 17, 1923.

Dr. J. A. McCaw, Presiding.

Hemorrhage into Vitreous.

G. L. Strader, Cheyenne, Wyoming, presented a youth, aged seventeen years, who had first noticed failure of vision ten days previously. There had been no other symptoms but the defective vision. The patient had had a very severe attack of influenza with pneumonia five years previously, but had made a good recovery. Three months previously he was said to have had a cold which threatened pneumonia. The corrected vision of the right eye was 20/70, and the vision of the left eye was limited to hand movements. Pupil reaction and tension were normal. Projection was good. The fundi could not be seen. There were large floating opacities in the anterior vitreous. The urine was negative as to albumin and sugar. The case was apparently one of hemorrhage into the vitreous.

Discussion. E. R. Neeper, Colorado Springs, said that the father had remarked that the boy had done a good deal of boxing and wrestling recently, and the strenuous exertion might have something to do with the hemorrhages.

Edward Jackson, Denver, had seen a case of sudden hemorrhage into the vitreous of each eye immediately after a severe bicycle ride.

W. C. Finnoff, Denver. If hemorrhages occurred ten days ago, they would now at least have a reddish tinge. The exudates are not characteristic of any particular ocular condition. In the right eye the exudate is very much farther forward than in the left.

W. H. Crisp, Denver, suggested that the history given by the family was unreliable as to the duration of the case, and that the exudates looked older and as tho due to hemorrhage far forward in the eye.

Melville Black, Denver, would be disposed to give the boy inunctions of mercury, with potassium iodid.

J. M. Shields, Denver, referred to the case of a girl who had recurrent massive hemorrhages in both eyes. Her coagulation time had been found to be ten minutes, and after two injections of serum from her own blood the coagulation time had been reduced to six minutes. The suggestion for this had been found in a recent article by Gonzalez.

Orbital Tumor.

H. R. Stilwill, Denver, reported the case of a farmer, aged twenty-nine years, who had come on October 17, 1922, on account of protrusion of the left eye. The proptosis was six mm. beyond the normal position, and it had been gradually increasing for a year, altho the patient thought that this eye had always appeared larger than the right. The history was negative with the exception of an attack of influenza four years previously. There was an occasional headache. The corrected vision of the right eye was normal, that of the left eye 20/25 with plus 4.50 sphere. The movements were normal and there was no diplopia. The media were clear, but the retinal veins were enlarged and somewhat tortuous, the disc margins blurred, and the nerve head swollen. X-ray examination by Dr. Brandenburg revealed a probable tumor mass of considerable density in the left orbit.

E. R. Neeper, Colorado Springs. A year or so ago I saw a patient with a similar history, and decided proptosis, which finally became very painful. The vision was greatly reduced, and I enucleated the eyeball. Two other surgeons and myself were unable to determine the presence of any mass

in the depth of the orbit, but it seemed as tho the periosteum were greatly thickened. Since that time I understand that a considerable ocular mass has developed from the back part of the orbit. At the time of enucleation the thickening of the periosteum seemed to be entirely uniform around the apex of the orbit.

J. M. SHIELDS, Denver: Ten days ago I saw a woman of fifty-three years who had marked proptosis, and definite bulging of the mesial wall of the orbit. On examination of the nose, a huge angiosarcoma was found occupying the whole of the ethmoids and the upper part of the antrum. Hemorrhage was so profuse that the growth could not be removed, and the case is being treated by inserted radium.

Embolism of Central Retinal Artery.

W. C. FINNOFF, Denver, reported the case of a man, aged thirty-five years, who recently, while filling a large coffee urn, had suddenly become blind in the left eye. There had been no return of vision. When the patient was seen twelve hours after the accident, the pupil of the left eye measured eight mm. in bright light, and did not react to light; the right pupil being three mm. The vision of the right eye was 1.0, that of the left eye nil. The left fundus showed the typical picture of embolism of the central retinal artery. The lower temporal artery especially was narrowed, and the small branches running up toward the macula were beaded. After amyl nitrit inhalations and vigorous massage, these branches filled with blood, but in a few minutes they assumed their beaded aspect again. The macular region had the usual bleached appearance, with central cherry-red spot. For three days after the first symptoms, small hemorrhages were seen in the retina. The first macular branch of the lower temporal artery was filled with blood for a short distance from the main trunk, and the remainder of the arterial wall was collapsed. The blood column pulsated synchronously with the heart beat. Vigorous massage drove enough blood from the main trunk to temporarily fill the smaller macular branches. Ten days after the onset, the embolus was visible at the bifurcation of the central artery. It was dark in color with ordinary light, but could barely be seen with red free light. Physical examination revealed a mitral lesion, probably mitral stenosis.

Pseudomyopia.

W. H. CRISP, Denver, reported the case of a young woman, aged twenty years, who had come complaining of attacks of defective vision. She had been subject to these attacks occasionally in the course of the previous two years, and of late they had come particularly after much reading. The patient was an inmate of a tuberculosis sanatorium. She was wearing R. +1.00 cy. ax. 180 degrees, L. +1.00 cy. ax. 165 degrees. Without correction her vision was right 5/30, left 1/20, and with both eyes together 5/15 partly. Plus lenses made the vision worse, and strong minus lenses moderately improved it. The retinoscopic reflex simulated myopia of about 5 D. in the right, and 7 D. in the left eye. At the trial case, however, she momentarily obtained vision of 5/6 partly with planos before both eyes. After eight instillations of atropin sulphat distributed over three days, a prescription was given for R. +1.25 sph. ⊃+0.37 cy. ax. 180 degrees, L. +1.12 sph. ⊃+0.25 cy. ax. 180 degrees. The corrected vision was 5/4. Two days after obtaining her glasses and three days after completion of the eight instillations of atropin, the combined vision of the two eyes with correction was less than 5/60, and retinoscopic examination showed distinct return of the spasmodic pseudomyopia. The patient admitted, however, that she had had a few spells of clearer vision in dull light. Three weeks later it was reported that the vision was occasionally clear for three days at a time, and then failed for a day or two. Six months later, the patient's physician reported that she was wearing her glasses and was doing well except occasionally when fatigued.

WM. H. CRISP, Secretary.

OMAHA AND COUNCIL BLUFFS OPHTHALMOLOGICAL AND OTO-LARYNGOLOGICAL SOCIETY.

March 28, 1923.

Dr. F. W. Dean, President.

Foreign Bodies in the Eye.

Dr. Harold Gifford summarized the history of three recent steel cases which were, in some respects, unusual. The first case, a boy who was hammering on a piece of iron, felt something strike him in the eye. He showed the scar of a wound in the cornea and a corresponding hole in the iris. The giant magnet was tried, but nothing was found and the iris was not seen to bulge. X-ray localization after this showed a foreign body in the ciliary region rather forward. Another trial with the magnet was negative. It was concluded that the foreign body probably had been free in the vitreous and had become tangled in the ciliary process after the first trial with the magnet, so that it was impossible to move it further. A postscleral incision was made, when the magnet brought out a small foreign body shaped like an arrow head, which had evidently been stuck in the ciliary body.

The second case was a man of forty who complained of decrease of vision in the right eye for the past four months. At first he gave no history of any injury, except that about four years before he thought he had had something removed from the eye, probably a piece of emery. On moderate dilatation of the pupil he showed the typical star-shaped cataract in the posterior cortex, often seen when a penetrating injury to the eye is sustained. When the pupil became more widely dilated, a small foreign body could be seen, and with the slit lamp the anterior surface of this was seen to have a metallic luster. Repeated trials with the giant magnet succeeded in moving this minute body very slightly at each trial, but it always resumed the former position in the lens. Since vision was about 20/200 it was considered best not to break the capsule of the lens to extract the foreign body, which would have resulted in complete cataract. The patient was sent home to await further developments.

The third case was that of a man who was sawing with a buzz saw when he was hit in the eye by a piece from the metal frame of the feed table. He showed a wound in the conjunctiva extending well back from the cornea. Vision was 20/20, the pupil dilated regularly, and nothing could be seen in the fundus. X-ray localization was made with Sweet's localizers, and the view was taken after moving the eye slightly. The report was of a large piece of metal in the eye. An antero-posterior view was ordered with markers placed under the conjunctiva above and below. This showed plainly that the piece of metal was slightly to the outside. After slightly enlarging the conjunctival opening, a large piece of steel was easily extracted with the magnet. It had not penetrated the sclera.

Hyaloid Remains.

Dr. Schwob reported a case of a woman, who first noticed about thirty years ago that the left eye was practically blind. She was told at that time that the trouble was congenital. She had always had considerable discomfort from her eyes and had frequently been refracted. When first seen by Dr. Schwob, vision was 6/30 in both eyes. In the right eye there was myopia of two to three diopters, and correction for this improved vision to 20/20. In the left vision was improved to 6/12. Ophthalmoscopic examination showed a whitish strand in the vitreous arising at the border of the nerve and extending forward to a short distance back of the lens. Numerous fibers radiated out from it into the vitreous. The unusual feature of the case was that the patient gave a history of being practically blind in the eye up until about four months before, when vision all at once began to clear up. Dr. Schwob believes that this is an instance of rupture of a hyaloid strand due to an enlargement of the globe with myopia.

Progressive Lens Opacities.

Dr. Sanford Gifford showed the case of a woman forty years old. She had been examined first by Dr. Harold Gifford seven years before, when refraction was made and nothing abnormal noted about her eyes. Four years ago the presence of peculiar leaf shaped opacities was noticed in the anterior part of the lens. These were first thought to be stationary, but observation for the past four years has shown some gradually progressive loss of vision. The case was examined with the slit lamp and the opacity could be seen to be confined chiefly to the anterior lens. The radiating lines apparently corresponded to the anterior suture lines.

Tuberculosis of Iris. Old Plastic Iridocyclitis.

Dr. Nora M. Fairchild presented Mrs. R., colored, age forty-three years, with the history of having repeated attacks of inflammation in both eyes, since the age of thirteen years. The initial attack followed being struck in the left eye by a thumb nail. Personal history and family history, negative.

First seen, December 6, 1922, at the University of Nebraska Dispensary, the left eye showed a moderate amount of circumcorneal congestion and there was a raised, somewhat irregular and lobulated nodule, resting on the inner side of the iris, partially covered by a gelatinous mass of grayish exudate. Besides this, there were six pearly white nodules, sharply raised above the surface, in other parts of the iris. The pupil was firmly bound down by adhesions, which have yielded but very little to atropin. Physical examination was negative excepting for diseased tonsils and a few bad teeth. Wassermann negative. X-ray of chest, negative. The tonsils were removed in a few days. Smears and cultures were negative for T.B. No sections were made. Complement fixation test for tuberculosis, negative.

Tuberculin test (0.2 mg. old tuberculin), positive. The reaction was general, local and focal.

At the end of two weeks, the conglomerate tubercle had disappeared, and there were but two of the small nodules remaining. At this time the right eye showed two small nodules of similar appearance. The pupil in this eye was also so firmly bound down that atropin has had practically no effect. Altho the eyes improved very much under the usual treatment, new nodules appeared at frequent intervals, so tuberculin therapy was decided upon. 1-25-23: O.T. 0.0002 mg. was injected. The patient reacted to this in the same manner as to the diagnostic dose, only in lesser degrees. 2-7-23: Has fresh conglomerate tubercle of the right eye, composed of six distinct nodules, veiled somewhat by the grayish exudate, with three small nodules at the limbus, external to the conglomerate tubercle.

When next seen, two weeks later, the conglomerate tubercle had become much smaller, and was becoming covered with pigment. The improvement has continued, and when seen by the society, March 28, there was one small nodule in the iris of the right eye, and two small, faint ones in the left eye. Vision with correction at this time was 20/30+ in both eyes.

Dr. J. M. Banister read a paper on Conservation in the Treatment of Frontal Sinuitis. Drs. Sanford R. Gifford and Waldron R. Cassidy read a paper on Some Uses of the Slit Lamp.

S. R. Gifford, Secretary.

COLLEGE OF PHYSICIANS OF PHILADELPHIA.

Section on Ophthalmology.

February 15, 1923.

Fistula of Cornea.

Dr. Luther C. Peter presented a patient, 65 years of age, who was operated upon for a secondary cataract by discission four years ago. Examination revealed a bleb at the upper outer corner of the section, about 2 1/2 millimeters in diameter, with an elevation of about 2 millimeters, covered by a thin layer of conjunctiva. Vision with correction 6/6. In view of the fact that the condition had existed for four years, it was thought best not to interfere.

Cicatricial Ectropion.

Dr. George H. Cross described a case of cicatricial ectropion which was exhibited by Dr. Posey at the last meeting of the Section. The deformity resulted from burns 22 months previously. There was absence of the lower lid of the right eye, and the mucous membrane was continuous with the surface of the cheek, with almost complete obliteration of the lid border. The ectropion of the lower lid of the left eye was not so marked. As the surface of the forehead and face was like parchment, so that a pedicle flap graft or sliding graft could not be secured, epidermal grafts from the arm were taken after the method of Esser and Gillies.

In the right eye, the lower lid was separated from the cheek by blunt dissection thru the rather loose fascial attachment. This restored the lower lid to its original thickness, except for the loss of the surface epithelium. The lid border was sutured to the eyebrow over the upper lid to provide a flat base for the epidermal graft which was placed over the denuded area. This was then covered with a layer of modeling compound, bandaged, and not disturbed for four days, at which time the modeling compound was cleansed and replaced. It was removed permanently about three days later. The lid is rather thick on the mucous surface, due to an overgrowth of hyperplastic tissue in the conjunctiva following the long exposure. If massage is carried out on the lid, it will flatten out and improve greatly in appearance. Should further rebuilding be necessary, what was done provides an excellent ground work.

The left eye was corrected by a dissection of the subcutaneous tissue of the lower lid from the skin over an area one-third larger than the surface to be covered, and in this area a proper shaped mold of modeling compound was buried, after it was first covered with an epidermal graft (taken from the arm) which was wrapped around the mold with the raw surface outward. The skin was then sutured in the line of the original incision, completely covering the buried, skin covered mold. At the end of five days, an incision was made with a sharp knife thru the original incision and down thru the graft on the mold into the modeling compound. This permitted the edges to retract and the mold to be lifted out, leaving a channel covered with epithelium. In a short time this filled up, and the lower lid is now in perfect apposition with the eyeball and the original defect entirely corrected. As in the other eye a course of massage will improve the surface and the skin will be flat and smooth.

Sarcoma of Ciliary Body.

Dr. J. Milton Griscom exhibited a woman, aged 26, who complained of failing vision in her right eye during the past six months. When the vision was first affected, she complained of pain continuing about one week, but subsequently there had been no discomfort. The cornea was clear, anterior chamber shallow, down and in, pupil irregularly oval, axis 135°, and no reaction to light. The lens, which was slightly hazy, was dislocated down and in, so that the upper outer margin could be seen. Back of this a nodular brownish-red mass, adjacent to the ciliary body and projecting about 4 mm. into the vitreous chamber, was observed. The retina was totally detached. Transillumination revealed a shadow in the area near the insertion of the external rectus. Tension, normal; vision, nil. Dr. Griscom proposed to enucleate the eye and hoped to be able to show the specimen at a later meeting.

Discussion. Dr. William Zentmayer said an interesting feature of Dr. Griscom's case is the hypotony. While a minus tension is at times seen with an intraocular tumor, it is unusual, especially where we have other conditions usually associated with increased ocular tension, as in this case, a partial dislocation of the lens and almost complete obliteration of the anterior chamber. The possible explanation is that the growth has destroyed the function of the ciliary body, thus bringing about a condition of synchysis.

Prolapse of Iris Following Cataract Extraction.

Dr. Howard F. Hansell considered prolapse occurring during operation and prolapse occurring during convalescence. The substance of his paper is given in the conclusions which he has drawn from his experience. 1st, to avoid surgical intervention immediately after the extraction; 2nd, to allow small stationary prolapse cysts to remain undisturbed; 3rd, cysts increasing in size, however gradually, should be cut off, the surface of the original incision freshened and brought together by a double needled suture, the needle introduced from within, outward; 4th, the conjunctival flap is practically worthless. (See p. 580.)

Discussion.—Dr. William Zentmayer concurred in Dr. Hansell's conclusions as to the best methods of treating this complication, with the exception of his final statement that a conjunctival flap is practically worthless. Recently he had two such cases to treat, following operations by visiting surgeons. In one there was a secondary glaucoma, and an attempt to free the iris was unsuccessful.

Dr. S. Lewis Ziegler said that the treatment of iris prolapse is either preventive or remedial. To prevent it one must avoid an irregular or scleral incision, or even a shoulder incision; and make an even, flat bevel of the cornea, with a free sweep of the knife held perfectly parallel with the iris. When prolapse occurs the iris should be pressed back by a sweeping movement of the iris spatula. If the vitreous is pressing the iris forward, it may be necessary to puncture the posterior capsule and allow some vitreous to escape. A gaping wound calls for corneal suture if the patient is quiet. The conjunctival flap of Kuhnt or Van Lint may also prove useful. The iris must be gotten out of the wound, or else protected by a sheet of beaten gold or thin oiled silk tissue, until corneal union has occurred.

Dr. Thomas H. Fenton reported the appearance of prolapse of the iris following cataract extraction in six cases, two to six days after operation, due to insubordinate and refractory behavior of the patients. Their recovery was uneventful altho operative relief had not been undertaken.

Dr. George H. Cross stated that he would like to say a few words in defence of the conjunctival flap. As Dr. Hansell had been so emphatic in his statement that the conjunctival flap proved of no value in prolapse of the iris after cataract extraction, he felt his remarks might be misinterpreted to include the use of the flap in other procedures than the one under discussion. He felt that in certain forms of injuries the conjunctival flap had been of most valuable assistance.

Dr. Hansell stated in conclusion that he may not have expressed himself clearly. The remark that the conjunctival flap was practically worthless is applicable only to the subject under discussion. The conjunctival flap in punctured wounds and other recent injuries to hasten healing is of the greatest value, and has been practiced by him with entire satisfaction for many years.

Hernia of Vitreous after Cataract Extraction.

Dr. L. C. Peter made a preliminary report on this condition as studied with the help of the slit lamp which is printed in full in this Journal, page 644.

Discussion.—Dr. S. Lewis Ziegler stated that the study of the intraocular tissues with the slit lamp is a fascinating field. As to the vitreous transfer from one chamber to the other, he thought there were limitations. He had always practiced his own V-shaped operation which so supported the vitreous body as to prevent its migration. He preferred to call this dislocation of the vitreous, where it followed looping of the lens or the Smith-Indian extraction. Here the whole body came forward, pressing the iris into a wide iridectomy and permitting a tremulous iris. In the other case, of sclerocorneal fistula with vitreous exposure following a too free discission, he would suggest reinforcement by a Van Lint conjunctival flap, or else a mild cauterization, to cause interstitial thickening of

the conjunctiva and thus remove the danger of future infection from an intercurrent attack of conjunctivitis.

Dr. Peter in conclusion said the slit lamp, altho of much scientific value, can only be of real value in general clinical work in so far as it can be made to contribute to the refinement of clinical diagnosis. If Dr. Ziegler referred in his operation to an incision thru and thru the lens, it is practically impossible to escape incising the hyaloid membrane. The hyaloid membrane and the posterior capsule are necessarily in contact. A discission operation which passes thru the posterior capsule must also go thru the hyaloid membrane, and a vitreous hernia will naturally follow. The extent of the hernia will depend largely upon the consistency of the vitreous body.

He regretted that he could not agree with Dr. Holloway in reference to the relative amount of trauma in the Barraquer and Smith operations. We are not, in this discussion, comparing the operative ability of the two advocates of these methods, but the two operations in themselves. The Smith operation, he feels sure, can be performed with a minimum amount of trauma, and with excellent results. The Barraquer operation, on the other hand, has twofold sources of trauma. First, the hard nonresisting instrument which is introduced into the anterior chamber is too inelastic to accomplish its work without damage to the hyaloid membrane, even in expert hands; and in the second place, the vibrations of the suction apparatus are probably a large contributing factor in the intraocular trauma resulting from the operation.

Mikulicz's Disease.

Dr. McCluney Radcliffe presented a case of Mikulicz's disease in a young colored man, aged twenty-four, who was admitted to his clinic at the Wills Hospital during January 1923. In December, 1922, the patient first noticed swellings of the upper lids, which were not tender to touch, following a diseased tooth. Examination showed bilateral enlargements of the lacrimal, parotid, and submaxillary glands.

The accessory parotid and submaxillary glands were not enlarged. The preauricular nodes showed bilateral enlargement. The cervical chain of glands showed a questionable enlargement. The tonsils were evidently enlarged, as they had been removed four months previously, but did not influence the lymphomata. He had several infected teeth, and also an involvement of both ethmoid regions as shown by the skiographic examination. The Wassermann and von Pirquet tests were negative. The treatment suggested was drainage of ethmoids, X-ray, thyroid, arsenic and the iodides.

Discussion.—Dr. William Zentmayer said that it might be of interest to review von Mikulicz's views concerning this disease today. In a very recent edition of his book, "Diseases of the Mouth," he says there is no one genesis for it. This has been shown by von Brunn, who states that the cases reported exhibit a continuous chain of slight variation from those which show a symmetric hypertrophy of the lacrimal and salivary glands to those in which the spleen and other lymphatic glands are involved (pseudoleucemia), and cases in which there are also associated blood changes (leucemia). The histologic changes in the glands also speak for a varied pathogenesis, as in some cases they present lymphocytes with eosinophiles and in other inflammatory and cicatricial changes. In other words, there is a lymphatoses of unknown origin, probably in most cases toxic. He points out that such a lymphatic enlargement may be procured by certain agents such as iodin or lead. Endocrin origin has been suggested, and one case is recorded where this affection was associated with congenital disease of the pituitary body.

Dr. S. Lewis Ziegler said that the above was a typical example of Mikulicz's disease. He had reported three cases and seen two others. The chief factors of interest were etiology and treatment. In his cases respiratory obstruction, either tonsillar or nasal, was the sole cause. No one had isolated any microorganism from the excised glands. The hyperplasia is a

true lymphoma caused by the irritation of perverted chemistry in the affected glands. The sympathetic system is at fault. The curious recession during an acute intercurrent disease, and recurrence, after this is cured, shows this. Osler's case disappeared during pleurisy but recurred after convalescence. Similar experience following pneumonia, appendicitis, cholera and erysipelas confirm this observation.

As to treatment, whatever increases oxidation brings relief. Tonsillectomy and nasal cauterization cured his cases, thru restored breathing. Dr. Radcliffe kindly asked him to examine his case, which showed respiratory obstruction from polypoid degeneration of the middle tubinate, and excessive purulent secretion from the sinuses. He would suggest, first, limiting treatment to the nose and watching the result. After that, arsenic, the iodids, pilocarpin, or apomorphia in small doses (gr. 1/200) at frequent intervals will increase lymphatic action and stimulate oxidation. The X-ray reduces the lymphoma but destroys the parenchyma of the gland.

E. G. SHANNON, M.D., Clerk.

CHICAGO OPHTHALMOLOGICAL AND CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETIES.

Joint Meeting April 16, 1923.

DR. ROBERT VON DER HEYDT, President of the Chicago Ophthalmological Society, in the Chair.

Melanosarcoma of the Limbus.

DR. WILLIAM H. WILDER had presented this patient on several previous occasions, and it had been thought that enucleation would be necessary; but intensive radium treatment had greatly improved the condition. The patient had received over 90 applications, varying in time from ten to fifteen minutes, in doses ranging from 25 mgs. to 100 mgs. Following these the growth began to disappear, so that at this time none of it was seen, even the pigment having almost entirely disappeared.

Serous Tenonitis; Report of a Case.

DR. WILLIAM L. BENEDICT AND DR. MARY S. KNIGHT, Rochester, Minnesota (by invitation) reported a case. (See page 656.)

Discussion.—DR. D. T. VAIL, Cincinnati, Ohio, believed that Dr. Benedict had presented another ophthalmologic entity, one that must be taken into consideration in the differential diagnosis of orbital cellulitis. Any acute orbital disease which was bilateral, which had chemosis as a prominent symptom, which had immobility of the globe and deep tenderness on pressure, with pain in the eyeball would, in the future, call for a consideration of tenonitis in the differential diagnosis. Perhaps, the disease was considered uncommon because it was not recognized.

Dr. Vail recently encountered a case which was in many respects very similar to Dr. Benedict's, altho the diagnosis of serous tenonitis was not made. This patient, a medical practitioner, was confined to his room in one of the hospitals of Cincinnati for several weeks with acute articular rheumatism. Many joints of his body were affected with painful swelling. The infection also produced myocarditis, endocarditis and pericarditis, with effusion in the sac; also some pleural effusion which produced painful and difficult breathing. He ran an erratic septic temperature, but just as he was beginning to feel fairly comfortable he developed the symptoms of orbital abscess affecting his right eye. Dr. J. A. Thompson diagnosed ethmoiditis and advised ethmoidectomy.

The man had somewhat the same group of symptoms that Dr. Benedict described; without, however, any signs of ulcer. While serous tenonitis was not diagnosed, Dr. Vail now thought it quite likely that it was a genuine case of this disease. The patient had the intense chemosis, the pain and the fixation of the eyeball in the socket. The greatest swelling was in the region of the tear gland, and so the diagnosis was acute dacryoadenitis. After three days the trouble began to develop in the other eye and went thru the same

clinical process. When the second eye became involved, it was manifest there was no orbital abscess present, and hence no operation was performed. Both eyes made a perfect recovery. The vision was never affected.

Dr. Vail has incised the chemotic swelling, using a sharp von Graefe knife and making many slits and stabs to create drainage, but he confessed that drainage did not result. The fluid is too albuminous to drain away. There seems to be too much fibrin present for that. He also had removed strips of the membrane with scissors, thinking to secure drainage in that way, but in this method the drainage was not satisfactory. The procedure that Dr. Vail had found did best in cases of extreme chemosis was complete tenotomy of the orbicularis palpebrarum muscle. This was a form of canthotomy at the external canthus, performed not in a line with the palpebral fissure, but by cutting the ligament across at right angles, to sever completely the orbicularis muscle from its outer attachment; cutting obliquely upward with one cut and obliquely downward with the other, and in doing so severing skin, tendon and mucous membrane at one clip. In this way the tension of the unyielding lid margins was broken, permitting the eyelids to fall away and relieve the stasis of circulation, the increased diapedesis and the transudation of serum within the tissue. It was never necessary to repair these cuts at the outer canthus, for in ten days time after the original trouble had subsided the cuts across the tendon of the orbicularis would have healed without leaving the slightest deformity.

Dr. George W. Boot was reminded of a case which he saw at the Cook County Hospital last year. A man of about 40 years was admitted for an emergency tracheotomy. There was marked stenosis of the larynx with a very obscure history of its origin. The condition in the larynx resembled scleroma. The right eye had been removed several years before on account of accidental injury. The left eye was markedly proptosed and immovable. The conjunctiva was chemotic and protruded between the lids. The periosteum at the margin of the orbit was thickened. A portion of this thickened orbital margin was removed for microscopic examination and was reported to be simply inflammatory thickening. No pus was found in the orbit at any time. The conditions in the larynx and in the orbit were apparently similar and related processes. The Wassermann was negative and antisyphilitic treatment was without effect on the process. X-ray pictures failed to show any new growth in the orbit. The patient was under observation for about a year, and when last seen the condition was unchanged.

Dr. Boot asked Dr. Benedict what amount of motion there was in the eye after the process had subsided. He criticized the treatment by salicylates, because of the small dosage, and said that if salicylates were to be given at all not less than 100 grains a day should be administered.

Dr. Benedict, in closing the discussion, said that the ulcers that occurred in the case reported were not a part of the disease, and in only one reported case were ulcers found to complicate the course. He believed they were due primarily to the chemotic condition of the conjunctiva, folding over the cornea, interfering with its nutrition, and allowing a recess where an ulcer could form. Also, the lower margin of the upper lid struck the cornea, and rested at the point of the chemotic junction, thus aiding the production of ulcer. The ulcer was a complicating factor in the diagnosis. If, at some time during the two months the condition had existed before examination, a corneal ulcer had developed, and the eye had become secondarily infected, it would have been impossible to rule out panophthalmitis. Because the fundus was clear, and there was no evidence of infection in the other eye, and because it was known that the two eyes had been the same up to the time the ulcer appeared, he considered that he was dealing with a disease in which the corneal ulcer was a complicating factor. If the tenonitis had occurred in one eye only, diagnosis would have been more difficult.

As to Dr. Boot's question regarding the motility, the eye now had full motion. One would naturally expect some restricted motility, because Tenon's capsule was connected with the walls of the orbit by dense bands which had some muscle fibers in them, which served as check ligaments, and the check ligaments were involved in the inflammation. If those bands were made thicker and stronger following the inflammation and became contracted, one would expect limited motility, but this patient had full return of motion.

The treatment was largely experimental because he could find no precedent. If larger doses of milk had been given, he might have obtained some relief. At that time, he believed it advisable to start with from 3 to 5 c.c. of milk, and unless there was a reaction to increase to 25 or 30 c.c. However, subsequent experience with milk had led him to believe that large doses should be given. The salicylates were given in as large doses as the patient could tolerate, altho he knew that larger doses were indicated. This patient could tolerate only from 50 to 60 grains a day.

That this case could not be considered one of tenosynovitis was borne out by the structure. There was no synovial membrane or fluid within the capsule, comparable with that found along tendons. This should be borne in mind, and possibly every reported case would throw more light upon the character of the disease.

Operations for Lacrimal Disease.

Dr. Joseph C. Beck, from the rhinologist's standpoint, presented his personal experiences with the various operations on the tear sac, beginning with the Toti, followed by the West with modifications, by Clark, and then by Beck's modification of West, then the Yankauer, Sauer, Wiener, Halle, Mosher, and finally the most recent development of a method of his own.

He gave no definite statistics as to results, but stated that practically all of these methods were a sad commentary on successful surgery, in the attempt to obtain normally acting physiologic structures. Most of the cases were reoperated with the removal of the tear sac, either by himself or others. The greater number of those not yet reoperated were going about with an epiphora. He brought out the importance of the pathologic changes of the tear sac, as to the indication for the operation. He also brought out the points concerning reparative osteitis in the bony excision of the lacrimal groove. The principle in his own latest modification of these operations consisted in the retention of a hard rubber tube in the newly made tract between the tear sac and the nose. This tube remained in place for ten days, thus preventing the reclosure by the reparative osteitis.

Discussion.—Dr. Harry Gradle agreed with Dr. Beck, that he had not seen satisfactory results from tear duct operations of any type. The flow of pus was stopped, but in a large percentage of cases a stenosis of the passage remained; and restoration of function was accomplished in less than 50 per cent of the cases. In getting results, restoration of function must be kept in mind.

He thought there was no difficulty in the chronic suppurative cases in stopping the pus, but that it was extremely difficult to accomplish the opening of the passage and keeping it open. In a few cases, medical treatment, added to the probing, would accomplish this purpose, but only in a comparatively small number. Operative measures, also in a small percentage, would accomplish this, but the solution of the problem had not yet been found. He hoped that Dr. Beck's operation would prove the solution, but thought it remained for time to show. Restoration of function must occur before a case could be considered cured. To accomplish that, one of the absolute essentials was that the lower canaliculus should not be slit, as had been done in the past. The profession was getting away from this and fewer and fewer slit canaliculi were seen at present.

Dr. Gilbert E. Seaman, Milwaukee, Wisconsin, said chronic suppurative

dacryocystitis was a constant menace to the eye. He did not regard a radical procedure as being a failure because there was occasionally some mucous secretion. He had had several cases where the patient had been entirely satisfied with the result. From the reports of the lack of success from the intranasal operation, he would not abandon the ophthalmic operation for any intranasal procedure he knew anything about.

DR. MICHAEL GOLDENBURG did not agree with Dr. Gradle's statement, "that one could not state a cure had been effected, unless the function of the part was restored." If a part was so diseased that it could no longer function it must be removed. A gangrenous leg, beyond the stage of restoration, would have to be amputated. Its replacement by an artificial one could not be expected to function normally. The statement that only 50 per cent of the cases were cured, had not been his experience. It was true, that some epiphora continued after the extirpation operation, but, surely, not so annoying or marked, and above all, the dangerous suppurating mass had been removed.

One should not lose sight of the fact that a lacrimal sac that came to the operating table had been pouring a highly infectious material into the conjunctival sac for months. This naturally must result in a chronic conjunctivitis, and the mere removal of the diseased lacrimal sac could not be followed by an immediate normal conjunctiva. The diseased conjunctiva then should be appropriately treated. It was further true that in some cases in spite of this treatment, epiphora still persisted. One should then remove the accessory lacrimal gland, which was a very simple procedure. The majority of cases complained of epiphora only when exposed to the wind.

The lacrimal sac extirpation did not demand extraordinary dexterity or technic. It did not destroy normal tissue and did completely remove a diseased part that was dangerous to the eye. It had been his observation in the last few years, in a majority of cases to find a cleft or dehiscence in the bony floor of the lacrimal fossa thru which a Bowman probe could readily pass into the ethmoidal region. He was inclined to think that probably many of the suppurating sacs were secondary to ethmoidal disease. He suggested careful investigation of these parts.

It was his practice in a suppurative case that had existed for some time, which did not respond to ordinary syringing in a reasonable time, to remove the sac. He rarely used the probes for any other purposes than exploration. His great objection to all the intranasal operations was that they did not remove a suppurating mucous membrane; that pus continued to be expressed into the conjunctival sac, and if the opening into the nose remained patent, there was the added danger of infecting the paranasal sinuses while in the recumbent position during sleep.

CLARENCE LOEB, M.D.
Corresponding Secretary.

SAN FRANCISCO COUNTY MEDICAL SOCIETY.

Eye, Ear, Nose and Throat Section.

January 23, 1923.

DR. E. F. GLASER PRESIDING.

Sympathetic Ophthalmia.

DR. VICTOR LUCCHETTI presented a patient, who, two years previously, had one eye enucleated because of fear of sympathetic ophthalmia, and now had symptoms of loss of vision.

Cataract Extractions in Vienna.

HANS BARKAN presented a preliminary report on cataract extractions in the Vienna clinic. Two hundred and forty-nine cataract cases were operated on by Meller in the Vienna Clinic between 1918-1922. The first fifty patients were in poor physical condition, and between sixty-five and seventy-five years of age. New instruments were not obtainable and sterilization was done by means of oil lamps. In addition, there was no heat in the buildings, so that technical difficulties were marked. For the most part, the Hess operation was used. The results were very good, the percentage of complications being small. This is

the more remarkable when one considers the difficulties under which Meller worked. In performing the operation three points were emphasized: (1) A large capsulotomy covering the entire pupillary area; (2) operating with a speculum; (3) did not emphasize the removal of cortical debris.

Discussion. K. PISCHEL laid special stress upon the necessity of the proper capsule forceps; while W. S. Franklin emphasized the reliability of the statistics presented. Nutting stated that, in reviewing Parker's cases in Detroit, he found fewer prolapses of iris after atropin had been used. Otto Barkan pointed out that Hess always used atropin, and Meller did not, and yet Meller had fewer prolapses, due to better postoperative care.

Plastic Surgery of Face.

LEO ELOESSER read a paper on plastic surgery of the face, stating that one cannot produce an ideal face by plastic surgery. Experimentally, it has been shown that in the transplantation of free grafts into scar tissue the nerves regenerate, but the lymph vessels do not, so that as a result of this the resistance of this tissue is greatly reduced. Pedicle grafts are more desirable because of the lymph channels that are present, but have the disadvantage of puckering at the base of the pedicle, where the graft has been turned. Eloesser overcomes this by means of a semidetached graft; that is, by cutting thru the skin, but leaving the vessels below, thus avoiding the unsightly puckering. He presented a case of facial paralysis, in which a portion of the temporal muscle had been transplanted into the orbicularis of the lid with good results.

Iritis with Infection of Mucous Membranes.

CHARLES MAGHY read a paper on iritis with infection of the mucous membranes. In an analysis of 2,796 cases, studied for an inflammation of the uveal tract, optic nerve or retina, Maghy found 112 cases which showed an infection of a mucous membrane, and which, after treatment in 97 cases, showed an improvement in vision which varied from 6/60 to 6/6. He pointed to the fact that it is only in recent years that the relationship existing between inflammations of the uveal tract and retina and those of a mucous membrane and the organs having an internal secretion have received thoro clinical and anatomic investigation. Altho it has been claimed by many competent observers that a direct transmission from diseased teeth, infected tonsils, pus in the sinuses, cause iridocyclitis, yet practically nothing is known concerning the routes of transmission that could in any way be considered positive and final.

There are many factors to be considered in the study of iridocyclitis, such as changes in the organisms themselves, previous traumatism, fortuitous embolism, gastrointestinal toxemias, and the anaphylactic state. Elschnig, quoted by the author, distinguishes two types: First, iridocyclitis occurring especially in women, in whom both eyes are attacked with K. P., posterior synechiae, and opacities in the vitreous; onset insidious and relapses frequent. Second, recurrent iritis; this form predominates in middle-aged women who are apparently healthy, followed by recovery, as a rule, without posterior synechiae; it invariably attacks only one eye, and there are frequent relapses with ultimate blindness. In the more severe cases there is ciliary injection, deposits on the posterior surface of the cornea and floating opacities in the vitreous. In some cases an initial attack of glaucoma is present at the onset. As time goes on, more and more posterior synechiae are formed, membranes appear in the pupil, and later cataract. In the most serious cases the eye becomes soft, and it is these cases that are so hopeless and end in total blindness.

Discussion.—HANS BARKAN brought out the fact that many cases of iritis are probably not due to focal infection and emphasized the necessity of a careful general examination; Pischel protested against the unnecessary wholesale removal of teeth. Otto Barkan told of a case of acute iritis due to a seminal vesical infection that recurred upon massage of the site of infection.

F. C. CORDES, M.D., Sec.

ROYAL SOCIETY OF MEDICINE, LONDON.

Section of Ophthalmology.

Friday, March 9th.

MR. A. L. WHITEHEAD, of Leeds, President.

Spring Catarrh.

MR. CYRIL WALKER, Bristol, brought, for diagnosis, the case of a woman aged 37, who presented warty growths on the lids. There was a history of tuberculosis of an elbow, extending to 15 years; she had a series of operations on it, and the sinuses healed two years ago. No disease had been discovered in the lungs. When first seen by Mr. Walker, two years ago, the warty growths were not so extensive as now. He scraped the nodules, and pathologic examination of the material removed showed no evidence of tuberculosis. She was more comfortable after scraping. Sulphat of copper applications seemed to have no influence either way. The fact that a smear revealed marked eosinophilia made him think of Spring Catarrh, which seemed to be a very uncommon disease in Bristol. He asked as to radium or other radioactive measures.

Discussion.—The PRESIDENT said he would have diagnosed Spring Catarrh if he had not heard the history, and he would apply radium.

MR. T. HARRISON BUTLER spoke of three of his cases of Spring Catarrh which had been treated with radium; two of them did remarkably well, the third not quite so well. He had seen tesselated forms of the disease in the East.

Tumors of Optic Nerve.

MR. HUMPHRY NEAME read a paper on this subject, supplemented and enforced by an instructive series of slides. It was based upon two cases of the kind he had had under care in the last two years.

The first was that of a boy, who was 14 years of age when first seen. From the age of 8 his mother had noticed that one eye was more prominent than its fellow. It was uncertain from the history whether the proptosis or visual defect was the first to occur. There was a progress in the proptosis from 1915 until the exhibitor saw him in 1920. The proptosis was a little upwards and inwards. Vision in 1920 was reduced to perception of light. Despite the proptosis, the eye movements remained good. The fundus, disc and macula of the good eye were normal, and vision 6/6. A nasal examination revealed nothing to account for the proptosis, and a skiagram of the skull did not show any abnormal shadows in the orbital region.

In 1921 Mr. Neame removed the tumor by splitting the external canthus, back to the orbital margin. On blunt dissection, a short piece of optic nerve was found immediately at the back of the eyeball. The tumor was elastic in consistency. The tumor was not completely removed; there was an escape of glairy fluid from the back of the tumor. After the operation, for a few days, there was proptosis caused by hemorrhage into the orbit; otherwise the after result was uneventful. Histologically, the optic nerve appeared to be normal. The pial sheath could be traced intact on one side, and almost intact on the other. Outside the pial sheath, above, there was increased fibrous tissue, and a considerable separation of the dural sheath from the pial; part of the growth had spread thru the pial sheath and involved the subdural space.

He referred to Mr. Hudson's paper on this subject, and showed some of the illustrations of it. Mr. Neame discussed the differences between gliomatosis and endothelioma. Of the 118 cases of gliomatosis collected by Mr. Hudson, 70 of the 113 whose sex was stated were in women, 43 in men, and more than 75% of the cases of this condition occurred in the first decade of life. In this condition the visual defect seemed primary, proptosis being a later development, and eye movements were but little limited. In most of these cases there was either papilledema or atrophy of the disc. In 50% of the cases removal was incomplete because of the extension of the disease into the optic foramen.

The points in the differential diagnosis of endothelioma from gliomatosis were: In the former the age of the patient was greater. In endothelioma

exophthalmos generally preceded interference with vision, because the tumor did not primarily invade the nerve, whereas in gliomatosis the nerve was diseased first. Limitation of eye movements was more marked in endothelioma, and there was circulatory obstruction in the lids and conjunctiva. If the media were clear, intraocular extension could be seen.

Mr. Treacher Collins said he found a helpful diagnostic factor was the progressive character of the hypermetropia, owing to the steady growth causing increasing pressure on the back of the globe. He had removed such a growth by the Krönlein operation, and so saved the eyeball. It was best to stitch the lids at the same time, because, the globe being anesthethic for some time afterwards, there was danger of ulceration. The tumor was cut across at the optic foramen, whence it must have extended into the skull, but no cerebral symptoms resulted, and the child lived many years afterwards, showing that the growth had not a high degree of malignancy. In a future case, instead of a Krönlein he would do the operation Mr. Neame performed in this case; it left less disfigurement. There were three varieties of such growths: gliomatosis, endothelioma, and neurofibroma, the differences being due to their originating in different classes of tissue.

Sir John Parsons objected to the term, "neurofibromatosis" in this connection, as it meant an association with nerves. "Fibromatosis" was preferable.

Mr. Leslie Paton expressed the hope that writers of text-books would cease to use the term "glioma of the retina"; some such name as "neuroepithelioma" would be better.

Mr. Neame, in his reply, said he did stitch the lids, and he thought that had a great deal to do with saving the eye.

Orbital Endothelioma.

Mr. Williamson-Noble had seen two cases of this condition during the last two years. The first case was that of a girl, aged 15, who was seen by Mr. Levy 12 months ago. The history was: Advancement of the right internal rectus, tenotomy of right external rectus in 1913. There was proptosis of the right eye for two months. The movement out and down was very limited, and slightly limited in the upward and inward directions. The pupil was inactive, the disc somewhat pale, and the vision was reduced to perception of fingers at a distance of 4 feet. The eye was enucleated, and the growth removed piecemeal.

When portions of the growth were embedded in paraffin, the structure resembled that of carcinoma of the breast. The slide exhibited showed a large amount of fibrous tissue, enclosing spaces containing numbers of large endothelial cells, with round nuclei. The cells showed a tendency to form spaces, a characteristic of endotheliomata; there was also a marked tendency to the formation of whorls. In the large whorls, those which had existed longest, the cells had undergone complete degeneration, showing as a plaque of fibrous tissue. These features brought the tumor into the endothelioma category.

This tumor closely invested the optic nerve, and pressed upon it, causing vacuolation of it, as shown in the slide. The tumor seemed to have arisen from the endotheliomatous cells wrapped round the strands of the pia arachnoid. High magnification showed definite continuity between the endothelioma cells and the endothelial cells on the inner surface of the dura. Still, this appearance might be produced by infiltration from without.

The second case was that of an orbital tumor in a boy, aged 3 1/2 years, and he also was under the care of Mr. Levy. There were chemosis, dilated inactive pupil, some swelling of the disc, and proptosis in a forward direction. When the eye was enucleated, the orbit was seen to be occupied by a solid mass. There was much swelling of the nervehead; but the physiologic pit was still present.

The tumor was received in pieces, and at first it seemed to be of a complex nature: some parts contained bone, some showed apparently normal cartilage, and deeply stained cells occurred in some parts, less in others. Some bleeding had occured into its substance. It seemed to arise from

the lacrimal gland, but the gland cells appeared normal, and they seemed to have no neoplastic activity. Sections did not seem to reveal any evidences of involvement of the optic nerve in the growth, involvement of dura or pia. The diagnosis seemed to be either sarcoma, teratoma or endothelioma. He inclined to regard it as periosteal chondrosarcoma.

Discussion.—MR. LEVY said the second of the cases lived six months after the operation; death resulted from intracranial extension of the original growth. No postmortem examination was allowed. He thought the growth had extended from the orbit forwards, rather than conversely. He regarded it as an endothelioma.

MR. M. S. MAYOU spoke of two cases of the kind which he had under his care. One was a child who had proptosis on one side, and a swelling in the temporal region of the same side. The latter the surgeon took for an abscess, and opened it, and there issued grumous material. When Mr. Mayou was called to the case, he said there was a tumor behind the eye, which was so badly proptosed that it had to be removed. The child died in about a month. The tumor consisted of very large cells packed together, with practically no fibrous tissue. It was an endothelioma, and probably started in the orbit. It filled the whole middle fossa of the skull, perforating thru the temporal bone, and bulging outside the temporal region.

The other case was in a girl aged 21. He removed the tumor, which was attached to the periosteum, and subsequently the whole orbit was cleared out. The section resembled one of scirrhus of a breast. Endotheliomata presented a variety of appearances because of the degeneration so likely to take place in them. Clinically, they all seemed to be very malignant.

MR. R. AFFLECK GREEVES regarded the second case as a mixed tumor; these sometimes contained cartilage, bone, and epithelial structures, and an arrangement like prickle cell nests. In the orbit they mostly arose from the vicinity of the lacrimal gland, and not from the gland itself. With this latter statement Mr. Treacher Collins agreed, and said a parallel case was that of tumors near the parotid gland.

MR. B. CRIDLAND, Wolverhampton, spoke of an extensive case of the kind, requiring a severe operation, which was performed by the late Sir Victor Horsley. The boy lived six months after the operation. Mr. Cridland thought that unless the ophthalmic surgeon was prepared to go on and do a large operation, he ought to hold his hand in these cases, and let an experienced cranial surgeon carry it out.

MR. LESLIE PATON spoke of a case of the kind which he showed 14 years ago, in which various glands became enlarged, finally those of the mediastinum, and the growth was identical in each. It was a clear case of transference of growth along lymphatics, not along the blood stream.

The PRESIDENT related a recent case of *neuroma of the ciliary nerve,* which was at first diagnosed as a tumor of the optic nerve. He exhibited the specimen.

H. DICKINSON.

SPECIAL ANNOUNCEMENTS

INTERNATIONAL CONGRESS OF OPHTHALMOLOGY POSTPONED.

The Committee of British Ophthalmologists appointed to organize an International Congress in 1925 finds, with regret, that it is unable to do so in accordance with the conditions under which the British invitation was accepted by the Washington Ophthalmological Congress in 1922. It will be remembered that at Washington it was decided that the next Congress should be strictly International and that German should be one of the official languages. The Committee has since been informed that the Société Française d'Ophtalmologie, the Société d'Ophtalmologie de Paris and the Société Belge d'Ophtalmologie have passed resolutions to the effect that they feel themselves unable to partici-

pate in a Congress if Germans are invited. The Committee is of the opinion that to proceed with the Congress in these circumstances would tend to perpetuate a schism in the ranks of Ophthalmology and militate permanently against the progress of the Science which all desire to promote. The Committee has, therefore, reluctantly decided to postpone the Congress.

VIENNA POSTGRADUATE COURSE IN OPHTHALMOLOGY.

October-November, 1923.

A second special course for postgraduate study in ophthalmology will be given during nine weeks, between October 1 and November 30, 1923, under the auspices of the American Medical Association of Vienna and the I. and II. Eye Clinics of the Allgemeines Krankenhaus, Vienna, Austria.

Hofrat E. Fuchs, the originator of the intensive postgraduate instruction, is kind enough to participate in the program. Hofrat Dimmer and Prof. Meller, chiefs of the two eye clinics, have once more consented to be active participants. The other lectures will be given by the docents Lindner and Bachstez, and the assistants Guist and Pillat. In addition, Docent Hirsch will lecture on the Hypophysis and assistant Kummer on Radium. The entire material of both clinics will be at the disposal of the teaching staff. The course has been so arranged, that the field can be covered in two months in a systematic and fairly comprehensive way.

The lectures on skiascopy, with cylinders and slit lamp, will be an introduction only to the work. There will be an opportunity to attend smaller classes in both eye clinics at the current fees. Ophthalmoscopic work will be given, using reflected light type of ophthalmoscope. The first two weeks assistant Sallmann of the second eye clinic will assist in the instruction in ophthalmoscopy.

Some preliminary knowledge of ophthalmology is assumed. The entire course will be given in English.

The fee has been fixed at two hundred and twenty dollars for each member. Application, with certified bank check to the amount of fifty dollars, should be sent to Docent Dr. Karl Lindner, Vienna I. Novemberring 12. Applications will be registered in the order in which their checks are received. The course will be given for a minimum of ten and a maximum of fifteen members. Only for the lectures in Histopathology by Hofrat E. Fuchs will it be possible for others to be present. For this, the fee for those not in the regular class will be twenty dollars. Details and further information as to this course can be secured by corresponding with the American Medical Association of Vienna, 9 Spitalgasse 21 Cafe Clinic, or Dr. K. Lindner, I. Novemberring 12, Vienna.

SUMMARY OF COURSE.

Hofrat E. Fuchs	Histopathology	30
Hofrat F. Dimmer	Physiology of the eye	15
Hofrat F. Dimmer	Fundus photography	2
Prof. Meller	Operations with practical demonstrations on the cadaver. Including practical work for the members (intraocular operations only)	36
Dr. Lindner	External diseases	24
Dr. Lindner	Bacteriology	20
Dr. Lindner	Skiascopy with cylinders	3
Dr. Lindner	Therapy	6
Dr. Lindner	Compensation, Simulation	5
Dr. Bachstez	External diseases	26
Dr. Bachstez	Muscles	20
Dr. Bachstez	Neurology	12
Dr. Lindner	Optics and Refraction	26
Assistant Guist	Anatomy of orbits	4
Assistant Guist	Ophthalmoscopy including red free light, the transillumination with the conus Guist-Purtscher and big Gullstrand ophthalmoscope	51
Assistant Pillat	Examinations including slit lamp	20
Dr. Hirsch	Hypophysis	4
Assistant Kummer	Radiology	1

5 to 6 p. m. reserved for conferences on subjects chosen by the students.

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JEAN MATTESON, Room 1209, 7 West Madison Street, Chicago, Ill.

PUTTING DROPS IN THE EYE.

This is considered so simple that patients are often told to do it, as if they would know how without any further instruction; just as they know how to open their eyes or look in a certain direction. But opening and directing our eyes are learned by many trials and with effort; only they were learned so long ago that the effort is forgotten. Many "trained nurses" have not learned how to put drops in a patient's eyes; and the majority of physicians, including oculists, have not learned all that they might know with advantage about it. If the collyrium is merely intended to be soothing to the conjunctiva, or to the mind of the patient, it may not be very important how it is put in the eye. But even then the best technic will make it more effective. If it is intended to secure a positive therapeutic effect on the tissues of the eye, technic becomes still more important.

The manner of instilling collyria to secure absorption of the drug they contain thru the cornea, should differ essentially from that of applying a drug for its effect in cleansing the conjunctival sac, or influencing the nutrition of the conjunctiva. Mydriatics, cycloplegics, miotics, etc., are made effective by reaching the interior of the eye, by absorption thru the cornea. This absorption will be greater and more rapid in proportion to the strength of the solution, as it reaches the cornea, and the prevention of its dilution by the tears. On this account strong cycloplegic solutions, placed directly on the cornea, are most effective.

The method of putting such drops in the eye is: Have the patient's head thrown well back, so that when the upper lid is held up, its lashes will be quite out of the way, and the dropper can be held directly over the upper edge of the cornea. Hold the eye open an instant, so that the layer of the lacrimal secretion on the cornea will thin down as much as possible and the surface become comparatively dry. Then deposit one small drop at the upper limbus, and hold the lids open while it spreads down over the whole cornea. In this way the largest amount of drug to be applied in the solution will enter the cornea and become effective.

Dilution of the solution by tears has the same effect as making it weaker to start with. The part of the drug

that falls on the conjunctiva and so gets into the subconjunctival lymph spaces and veins, is no more effective than that which may fall on the skin of the lids or the face. The solution, diluted with tears, will some of it get back in contact with the cornea and so do some good. But this diluted solution is much less effective than the strong solution applied directly to the corneal surface.

For the same reason a single drop should be applied at a time, because the solution can then be safely made twice as strong, as if two drops were to be instilled each time. The dropper used should be one that gives as small a drop as possible. One with a narrow tip will give a drop half the size of that given by one with a broad end. The effect of the small drop on the iris or ciliary muscle will be just as great. But its toxic effect, or the irritation it causes to the conjunctiva, will be only half that of the larger drop.

When the collyrium is to affect the surface of the conjunctiva, the amount instilled should be as much as the conjunctival sac will hold, and it should be placed as far from the cornea as possible. In this case the lids are kept away from the cornea; to prevent the solution from reaching the corneal nerves until it has been well diluted with tears. Most collyria that cause smarting and burning, are felt more severely and longer if they reach the cornea in full strength. If the lids are released immediately and the whole application promptly washed out of the eye by tears, the suffering may be less; but so is the therapeutic effect.

Generally, the best way to introduce such a solution is to open the lower sac of the conjunctiva by drawing the temporal end of the lower lid away from the eye, thus forming a cup to hold the solution. It is best to have the patient lying on his back with the head slightly turned, so that the outer canthus is as high as the inner canthus. Afterward pulling up the temporal end of the lid, a cavity is formed beneath it, into which the collyrium passes as the lower lid is released. Keeping the two lids drawn apart somewhat, the fluid makes its way, diluted by tears, toward the lacrimal passages. The cornea exposed between the retracted lids gets the least possible amount of the drug instilled.

When it comes to cleansing the conjunctival sac, not "sterilizing" it, for that is impossible, fluid largely in excess of what the sac can hold must be passed thru it with a rush, from the nozzle of an irrigator, or by forced expulsion from a large pipette. With any form of irrigator there is more danger of injury from the end of the irrigator, than from the force of the current. Along with such irrigation of the eye should be combined manipulation of the lids, that will cause the loose transition folds of the conjunctiva to rub on each other gently, but with enough force to displace adherent mucus and other discharges; and such manipulation should be repeated in alternation with the flushing. Recently, Dr. T. M. Li, of Peking, China, called the writer's attention to a little maneuver which he had learned from one of his nurses. When it is desired to keep as much fluid in the eye as possible, a fold of skin perpendicular to the lid margin is seized between thumb and finger, and the lid lifted away from the eyeball with it.

In all such manipulations it is important to have the patient's head fixed by resting on the back of a chair or lying on a firm pillow. Nurses and home attendants of patients have to be actually trained in the manipulations required, if treatment by collyria is to be effectively carried on by them in the absence of the doctor.

E. J.

ORIENTATION AND EQUILIBRIUM.

To maintain, or restore the proper mechanical relation of the body to its surroundings, is an extremely important bodily function. The forces of gravitation, inertia, accidental movement and arrest of movement, must all be recognized and adjusted for, if we are to maintain our position, safety and comfort. The recognition comes thru

the sense organs, especially the sight, hearing, function of the labyrinth, and impressions on afferent nerve endings in the skin, muscles, tendons and joints. The adjustments are effected and maintained by accurately coordinated tonic and motor impulses distributed to the muscles. The coordination is secured, not by some anatomic center, a certain group of nerve cells; but by a variety of nerve path associations, brought about by previous voluntary effort to make these movements, or maintain the position in question. Some have been attained by effort on the part of the individual, acquired coordinations; some by the effort of his ancestors, inherited coordinations or associations. Accurate orientation is a large part of the process.

Equilibrium cannot be understood if it is thought of merely as being able to stand without falling, or to keep a proper position for swimming. The mechanism that enables us to do these things, enables the aviator to keep his balance in the air, and gives us our judgment of distance and of rate of movement. The automobile driver moving rapidly toward a certain point suddenly perceives another automobile moving toward the same point. He judges instantly whether his, or the other machine, will reach that point first; whether at the present rate of speed one will pass the intersection safely before the other arrives; or whether there will be a crash, unless the rate of approach of one or both is changed. The same faculty enables the man in the air to avoid the tree tops, and the man on the street to avoid his fellow pedestrians. The ability to maintain equilibrium is a constant condition of continued life and comfort.

Objective study of this power in the lower animal gives a broader understanding of the subject than is possible thru consideration only of our own sensations and experiences. To maintain equilibrium is a less complex process for the fish, than for the man, or the bird. Such experiments as are referred to in the book notice on page 708, are most useful in affording a general conception of the function, and the need for it in the maintaining of life. But for the understanding of pathologic processes and symptoms in man, we must have a clear conception of the differences of the physiologic processes of the human being from those of the lower animals, and of the relations of the objective phenomena of impaired equilibrium to the sensations it causes.

The fish, whose movements and position are so directly influenced by currents in the water that press on every point of its body, is provided with a mechanism for responding to contact experiences, that may well dominate the whole function of equilibration. The turtle, encased in a rigid shell, may well have to depend more on an internal mechanism, the labyrinth, guarded from contact or touch, and so more delicately responsive to gravitation and inertia. The higher vertebrates, covered externally with fur or feathers, or man with his surface covered with clothing, thus losing much of the usefulness of touch in orientation, also must depend on the function of the labyrinth, and particularly on the more highly developed power of sight.

The mammalian retina spread out on a concave surface, to each point of which an impression comes by rays of light from a single point of the external world, helps to an exactness and wide range of orientation; far beyond what is possible thru any macula or crista of the internal ear. These radiations come from the object held in the hand or from the fartherest star; and thru the retina give us a definite perception of relations thruout space. With the development of binocular coordinations, the accurate judgment of distances, resting on the association of impressions made on the two eyes and "muscle sense", the afferent impulses from delicate muscles and tendons, the share which the eyes and their accessory organs and connected nerve tract have in orientation and equilibration—balancing—becomes very large.

The past-pointing, fall to the side and nystagmus of the Barany tests, are "forced movements", objective

symptoms of dynamic origin. Vertigo, apparent movements of objects, nausea and headache, are subjective symptoms of disturbance of equilibrium. It becomes easy to understand how the same symptoms arise from disturbance of function of the ocular movements and retina. In eyestrain and in the subjective symptoms of ocular muscle imbalance, there is disturbance of equilibrium, of established relations with the external world, very similar to the irregular and unaccustomed disturbances of relations that give rise to sea-sickness or car-sickness. Naturally such disturbances of relation occasion similar subjective symptoms. Appreciation of the nature and conditions of equilibrium in general must bring a better understanding of many of the most common and important problems that we have to solve in ophthalmic practice.

E. J.

THE WESTERN MEETINGS.

The meeting of the American Ophthalmological Society at Colorado Springs was successful in all respects. The attempt to hold a meeting at Niagara Falls in 1877 failed, because only six members were present. Since then no attempt has been made to hold a meeting west of the Allegheny Mountains until this year. The farthest west its meetings have been held, heretofore, was Hot Springs, Virginia. That this year marks an epoch in the life of the Society is emphasized by the fact, having met this year in the "West," the Society decided to meet next year in the "East"—at Hot Springs.

The attendance this year included about fifty members and twenty-five guests. This is almost up to the average of late meetings in the East; if we exclude that of last year at Washington, when, following the International Ophthalmological Congress, almost one hundred members and nearly as many visitors attended. The restricted membership of the Society and its policy of admitting only those ophthalmologists who have attained prominence by their original writings, prevent it from being the organization fully representative of American ophthalmologists. But its liberal welcome to visitors in good professional standing and the scientific interest and charm of its meetings, should cause it to be better known to all active students and practitioners of ophthalmology.

A notable event was the starting of an endownment fund, to encourage original research. This was done on the suggestion of the President, Dr. Wilmer, cordially adopted and productive of a fund of several hundred dollars at this meeting. With the Knapp Memorial Fund of the Ophthalmic Section of the American Medical Association and the rapidly growing fund of the American Academy of Ophthalmology and Oto-Laryngology, younger workers in our special field need not be deterred by expense from undertaking what promises to be fruitful original investigation.

The officers chosen for the coming year are: President, Alexander Duane, of New York: Vice-President, Cassius D. Wescott, of Chicago; Secretary-Treasurer, Thomas B. Holloway, of Philadelphia. The last was reelected. To nonmembers he is the most important officer, because to him should be sent subscriptions for the Transactions. A few of the papers and reports read at this meeting will also be published in this JOURNAL.

The meeting of the Pacific Coast Oto-Ophthalmic Society at Los Angeles began on the last day of the meeting at Colorado Springs, so it was impossible for those that attended the one meeting to reach the other. Except local visitors, the Los Angeles meeting drew but few from outside its own membership. Suffering from its nearness in time and separation in distance from the meetings preceding and following, it still was able to muster, under the presidency of William H. Roberts, of Pasadena, California, a fair attendance and go thru with an interesting program of papers, discussions and clinics; demonstrating that it is a live society, worthy to represent the great region of the Pacific Coast.

At the Section meeting in San Francisco almost three hundred members

registered, making a gathering about as large as those of recent years in eastern cities. The sessions of the Section on Ophthalmology were held only on the afternoons of Wednesday, Thursday and Friday. At these three sessions were presented twenty-one papers, with the discussions they provoked and numerous demonstrations of instruments and reports, besides the executive business for the Section. Chairman John F. McReynolds, of Dallas, Texas, and Vice Chairman John Green, of St. Louis, both proved good presiding officers—prompt and positive—and the work of the Section moved smoothly along with the best utilization of the time.

The officers chosen for the ensuing year were: Chairman, George S. Derby, of Boston; Vice Chairman, Walter S. Franklin, of San Francisco; Secretary, William C. Finnoff, of Denver; Member of the House of Delegates, Cassius D. Wescott, of Chicago. With the Chairman, who was first made Secretary of the Section ten years ago, to instruct the new Secretary in the duties of his office, the work of the Section should go on without any interruption of the smooth efficiency that has characterized it since the practice of reelecting the Secretary thru several years was begun with Dr. A. E. Bulson, who became Secretary in 1904 and Chairman in 1911. The Knapp medal was awarded to Dr. Martin Cohen, of New York City, for his paper on the significance of pathologic changes in the fundus in general arterial and kidney diseases, presented last year.

In the House of Delegates, the proposition to do away with delegates from the Sections, or to deprive them of any vote in the House, was laid to rest by a negative vote that included a good majority of the delegates from State Medical Societies. Chicago was chosen as the place for meeting next year. The custom, inaugurated last year, of the former President and the newly installed President together visiting the different Sections was contiued by Dr. de Schweinitz and Dr. Wilbur. An extremely enjoyable occasion was the dinner given on Monday evening by the ophthalmologists of San Francisco and vicinity in honor of Dr. de Schweinitz, in which about one hundred members of the Section participated. On Thursday evening the alumni of the University of Pennsylvania gave a dinner for Dr. de Schweinitz, at which Dr. Wilbur was also a guest.

With the meeting being held in Denver as this issue goes to press, the ophthalmologists of the Western United States can rest well satisfied with their summer's program; and join to make the meeting at Washington in October a great success, remembering that the "American Academy" started as the "Western Association," and first gathered under its present name in Denver, nineteen years ago.

E. J.

BOOK NOTICES.

Die Mikroskopie des lebenden Auges. Prof. Dr. **L. Koeppe.** Berlin. Julius Springer. 1922.

Koeppe has opened an entirely new field of investigation and has cultivated it well. His first communications appeared in v. Graefe's Archiv, and it is on account of their originality that he was awarded the Welz-Graefe prize. These articles appear here in book form, augmented by excellent illustrations by Meesmann.

As the original combination of Gullstrand slit lamp and corneal microscope does not allow of penetration deeper than the anterior third of the vitreous, Koeppe made use of a contact lens on the cornea, which projects the image of the fundus immediately behind the posterior lens capsule. For the most advantageous conditions, the light of the slit lamp should be produced by a microarc lamp and observing instrument should be not the ordinary corneal microscope of Czapski, but a bitumi; one tube with the objective, and division of light by prisms into two oculars. The image seen is reversed (the orthobitumi which gives an upright image is made only on special order). The arm with the

lamp is put frontal to the patient, and the light is diverted into the eye by a mirror.

As one expects from Koeppe, the description of the findings goes into the minutest details, and does therefore not keep the reader's attention undisturbed. However, the investigations open such a new field, that we must be willing to read and reread the text.

Of course this exploration has its limits. The refraction is of importance; the higher the hypermetropia—all things being equal—the farther we can see into the vitreous, and the easier the fundus is to be seen. In myopia of more than 5 diopters, the mathematical conditions make it very difficult, if not impossible. Not very much more than the region of the macula and disc can be explored in the fundus; chiefly because of the disturbing astigmatism of the peripheral parts of the contact lens.

Koeppe has been privileged to see many things for the first time. With Schieck, he found the earliest symptom of choked disc, the lifting up of the membrana limitans over the porus opticus, then the enlargement of the perivascular and the solitary lymph vessels on the disc. In the optic neuritis, the lymph under the limitans is rather directly opaque. In a case of tuberculous vasculitis, Koeppe thinks he can localize individual tubercles at the places where the vessels divide. The picture of the vitreous in detachment of the retina does not give support to the "traction theory" of Leber-Nordenson.

Every one who is interested in the progress of his lifework will study these hundred pages, and many will be tempted to repeat Koeppe's investigations. They ought to keep in mind the words of the introduction: "one should try with the greatest patience to penetrate in the living microcosm of the posterior part of the eye."

The above text is followed by "the spectroscopy of the living eye with Gullstrand's slit lamp"—but that is another story. At present this needs such a complex apparatus that such investigations can be undertaken only by the few.

E. E. Blaauw.

The Principles and Practice of Perimetry. By **Luther C. Peter,** A.M., M.D., F.A.C.S., Professor of Ophthalmology in Temple University Medical School, and in the Graduate School of the University of Pennsylvania. Second Edition. 281 pages, 161 engravings and 5 colored plates. Philadelphia and New York, Lea and Febiger.

Altho not representing all that has been written of late years regarding perimetry, this volume shows no mere perfunctory revision; but a healthy development in keeping with seven years progress of a subject that is attracting a large amount of attention, and furnishing a field for fruitful original work. Many who have specialized in ophthalmic practice have a very imperfect acquaintance with the methods of studying the field of vision and the significance of the data they furnish. This book meets a real need and is worthy of the close attention and confidence of the student and practitioner of ophthalmology.

The greatest change in the book is in the more complete presentation of the anatomy and physiology of the visual pathway; which occupies the first part, seventeen pages, and the second, twelve pages. Part III, fifty-one pages, deals with methods of field taking, instruments, charts, etc. Part IV, twenty-four pages, takes up the general pathology of the field of vision, and Part V, twenty-two pages, the special pathology. Part VI, seventeen pages, is devoted to functional nervous diseases. There is also an appendix of twenty pages, in which the field of fixation, the measurement of squint, the determination of the angle Kappa of Landolt, the charting of double images, and the location of foreign bodies are described. These are side uses of perimetric instruments of great practical value. There is also a classified bibliography of fifteen pages which will furnish the reader an effective guide in his advancing studies of visual field changes.

The value, limitations, conditions of accuracy and detailed methods of investigation, are brought out with admirable clearness, but with brevity;

and there is a fine appreciation of the relative importance of the many suggested instruments and methods for bringing out the essential facts sought. From the section on "Methods of Field Taking," we quote: "To state specifically and concisely, therefore, the special role of the three varieties of methods of perimetric study, the hand method should be employed as a rapid routine means of preliminary study of cases which seem to show gross defects of peripheral limits; the perimeter is essentially adapted to accurate measurement of the peripheral field; and the tangent plane is the instrument for careful analysis of central and paracentral defects."

The color plates illustrate the current conception of the visual tracts, and the physiology of vision, the effects of surrounding field and previous exposure on the perception of colors, and the course of the nerve fibers in the retina as shown by a case of opaque nerve fibers. A minority of the illustrations in the text show apparatus and methods of arranging and using it. The majority are reproductions of charts of visual fields, and illustrative diagrams. All are well executed and show what they are intended to illustrate.

The typography is particularly good, the type being large and clear; the press work is neat, the paper opaque and uniform. There is an adequate index. On the whole the author has reason for satisfaction with the result of the large amount of labor that has evidently been expended in the preparation of this edition.

E. J.

Labyrinth and Equilibrium. By **Samuel Steen Maxwell,** M.S., Ph.D., Professor of Physiology in the University of California. 164 pages, 11 illustrations. Philadelphia and London, J. B. Lippincott Co., 1923.

This is one of a series of monographs on experimental biology, published under the editorial sanction of Jacques Loeb of the Rockefeller Institute, T. H. Morgan of Columbia University and W. J. V. Osterhout of Harvard. Of this series, ten have already been published and five are in preparation, with others to follow. This is the one, thus far published, of most direct and special interest to our readers.

The first three chapters are given to a general opening up of the subject. They are headed: I Introduction. II Compensatory Motions and Compensatory Position, III Forced Positions and Forced Movements. The other eight chapters are entitled: IV The Labyrinth as a Whole. V Reactions of Non-Labyrinthine Origin. VI Experiments on the Semicircular Canals. VII Experiments on the Otoliths. VIII The Mechanism of the Dynamic Functions of the Labyrinth. IX The Mechanism of the Static Function of the Labyrinth. X The Tonus Effects of the Cristae and Maculae. XI Nystagmus. The list of the literature, two hundred and forty titles, includes chiefly recent articles and monographs.

The experiments that form the basis of this work were done on the lower animals, particularly the selachian fishes, the shark, dog-fish and ray; but the results are compared with those obtained from the higher vertebrates, particularly rabbits and pigeons. The facts most directly belonging to ophthalmology are found in chapter V, reactions to retinal stimuli, and chapter XI, nystagmus. The retinal reactions are studied by observing the positions and movements of the animal experimented on, with the eyes open and with them occluded; the influence of retinal impressions being deduced from the variations in behavior thus caused. In the chapter on nystagmus the suggestion is made that the two components should be called, not the "quick" and the "slow" components, but the "compensatory" and "return" movements or phases. This change of nomenclature connects the movements with their purpose, and so makes for clearness of significance.

The aim of this series of monographs is well expressed in this passage, from the announcement made by the Editors of the series. "Biology, which not long ago was purely descriptive

and speculative, has begun to adopt the methods of the exact sciences, recognizing that for permanent progress not only experiments are required, but quantitative experiments. It will be the purpose of this series of monographs to emphasize and further as much as possible this development of biology. Experimental Biology and General Physiology are one and the same science, in method as well as content."

E. J.

Senile Cataract, Method of Operating. By **W. A. Fisher,** M.D. (See p. 611.)

The reviewer does not know when he has ejoyed a discussion of cataract, without taking part in it himself, as much as he has in reading this little book of 256 pages, for it gives the favorite methods of the eminent authorities of a number of countries, the principal exception being the French, (he does wish that Fisher had obtained an article from such a sane and careful operator as Terrien,) thus omitting what seems to him to be the safest method of handling the wound, whereby it is permanently coapted by conjunctival or corneal sutures. The author is indeed fortunte in getting some of the World's greatest ophthalmic surgeons to present in their own way the methods which result best in their own hands. An ambitious reader and operator can select from the discussion of this book a form of operation which he may desire to adopt as a routine procedure, and one which he believes will give the best results.

The work has at once met with favor, for on the occasion of a recent visit to the East by the reviewer, this book was brought out and commented upon by a number of well known cataract operators. We have all of us tried to find the safest method for the patient and the most successful as regards restoration of sight. No two operators upon cataract use exactly the same procedure. Most of them believe the capsulotomy operation is the safest and many of large experience feel they must not depart from this method.

Fuchs of Vienna describes the capsulotomy operation, Barraquer the intracapsular operation by the erisifake. (The reviewer secured this instrument a year ago and has tried out the method about ten times, which he thinks is enough, however, to prove to him that in his hands at least a simpler procedure is more conducive to best results.) Henry Smith describes the capsulotomy operation in one chapter and the intracapsular operation in another. This last is also taken up by Holland of India and by the original intracapsular operator, John W. Wright of Columbus, whose form of operation is perhaps the simplest. Fisher in two chapters takes up the intracapsular operation as adopted by him and describes a simple method of acquiring operative technic by the use of the mask for holding kittens eyes. The book is particularly well illustrated, but the typography is open to the same objections as his work on Ophthalmoscopy, Retinoscopy and Refraction.

H. V. W.

Ophthalmoscopy, Retinoscopy and Refraction. W. A. Fisher, M.D., F.A.C.S., Chicago, Illinois (also see p. 60).

This octavo of 218 pages is a practical explanation of the subject which the author has made simple, interesting and within the reach of any physician or medical student. His method of teaching ophthalmoscopy by a simple schematic eye model, in which pictures of different eyegrounds are placed, and in which the size of the pupil may be varied, is the easiest and most practical form of teaching the student to see the bottom of the eye. The chapter on systematic examination of the eye is clear, and if its rules were followed nothing important in the diagnosis could be missed. Optical principles in applied refraction, the several optical measurements and prescriptions are clearly shown.

The book has 248 illustrations, including 48 colored plates; the latter are replicas of eyegrounds used in his eye model. So much for the contents

which are good and could hardly be bettered. But the reviewer must criticize the printing. The paper is highly glazed, doubtless for the reason that a number of colored plates are printed in the text. These had been better put in as inserts, and a mat finished paper used for the text. The type is small pica, 12 pt. Scotch and not leaded. This type has heavy perpendicular and very light horizontal lines, the letters are very close together; so that the combination of the type and the glazed paper makes the page very hard to read. Our eye books should always be printed on a paper and with a form of type that is easily legible and that does not tire the eyes. The book was evidently gotten out by a commercial, not a medical printer; as the latter have been pretty well educated in the form of type, paper, and printing that is scientifically and optically correct. When this work is followed by a second edition, it is to be hoped that the author will see that the face of the type is changed. H. V. W.

CORRESPONDENCE.

The Eye in Beri-Beri.

To The Editor: In his paper on "The Eye in Beri-Beri", in the May number of your JOURNAL, Dr. Antonio S. Fernando of Manila comments on the scanty literature of the subject of a disease which he believes to be responsible for a great deal of blindness in the Philippines. May I point out to him, and to others who are interested in the subject, that they will find the eye complications of this disease dealt with at some length in the chapter on Beri-Beri, pages 405-415, of my work on Tropical Opthalmology. (Oxford Medical Publications, 1920.) The literature of the subject has also been given at some length at the end of the chapter.

I am the more emboldened to make this communication from the fact that the chapter of my book referred to will, I think, answer some of the difficulties and doubts that are raised in Dr. Fernando's paper.

R. H. Elliot.

London, England.

ABSTRACTS

Magitot, A. Ocular Tension, and Some Experimental Modifications. Ann. d'Ocul. 1923, v. 160, p. 11-15; 81-105.

In this paper, the author describes his experiments to obtain, artificially, increase or decrease of ocular tension, and their results. Most of them were performed on the dog, cat and rabbit, but some were on cases of old optic atrophy. The Schiötz tonometer was used on the human subject, but the manometer on animals, and the instruments are described and illustrated. In speaking of tension during life and after death, an experiment is related in which a dog was bled to death. The tension at once dropped from 25 mm. Hg. to 10 mm. Four hours later it was 6 mm., at the end of the twelfth hour it was 2 mm., and at the end of the fifteenth hour it was zero.

Ocular tension has two components; one due to the general blood pressure and one which is possessed by the ball itself. The relation between general arterial tension and ophthalmotonus is shown by means of experiments involving the use of amyl nitrit, ergotoxin and pituitrin. Ligation of the vortex veins caused a rise in the ocular tension. Removal of the aqueous by aspiration was immediately followed by the fall of the tension to zero, but in five or ten minutes it started to rise and soon was greater than the tension before the aspiration. Later, it fell to the original figure. But if the carotid was ligated previously, there was no hypertension, and the return to the normal tension was very gradual.

A heavy weight upon the ball at first reduced the tension, but when this was removed, it returned and passed the original amount, then fell to the normal. In both this experiment and in aspiration of the aqueous, there were oscillations of hyper- and hypotension,

which were more marked in the weight experiment before the normal was established. Irritation of the iris caused a rapid rise and gradual fall of tension. It is probably caused by way of the nervous system.

In the cat and dog, intravenous injections of certain substances produced a fall of ocular tension, which in every case was dependent on the general blood pressure. In the rabbit, however, the results were the same as originally described by Hertel, i. e., a loss of ophthalmotonus. Magitot, however, does not accept his explanation of osmotic changes, but ascribes the result in rabbits to direct or indirect action on the caliber of the ocular vessels. Numerous graphs and a large bibliography accompany the paper.

C. L.

Terson, A. Follicular Adenoid Conjunctivitis. Ann. d'Ocul. 1923, v. 160, p. 105-109.

This syndrome consists in the presence of follicles, chiefly in the inferior fornix, accompanied by the presence of adenoid tissue in the nasopharynx. From the examination of two or more generations of numerous families, the author has come to the conclusion, that with the exception of cases due to local or general causes, the disease is a hereditary luetic or tubercular stigma.

C. L.

Lapersonne, F. de. Late Ocular Complications of Spinal Anesthesia. Acad. de Méd. 1922, Dec. 19. Abst. Gaz. des Hôp. 1922, v. 95, p. 1639.

The author comments on the work of Terrien, and states that deaths are much less frequent since cocain has been replaced by stovain or novacain. On the other hand, there is frequently an involvement of the cranial nerves, especially the sixth. A paralysis of this occurs about once in every 200 to 250 anesthesias. It appears on the third or fourth day sometimes, but usually is delayed until the twenty-fifth to the thirtieth day. It is accompanied by headache, vomiting and rigidity of the neck, is almost always unilateral, and in manifested by diplopia, slight deviation and nystamic movements in the sphere of the affected muscle. Recovery takes weeks or months. It is probably due to a meningeal irritation involving especially the abducens because of its exposed position.

C. L.

Archard, C. and Thiers, J. Dissociated Oculosympathetic Syndrome. Soc. de Neur. Feb. 2, 1922. Abst. Gaz. des Hôp. 1922, v. 95, p. 221.

The Claude Bernard-Horner syndrome may be so dissociated as to be reduced simply to a pupillary trouble. This explains the inequality of the pupil so often found in lesions of the apex of the lung, and especially tuberculosis of the lungs.

In a female with fracture of the left clavicle, they found enophthalmus and nonparalytic ptosis, but the pupil did not differ from that of the other side and reacted similarly. These symptoms were not present before the injury and ameliorated as the fracture healed.

C. L.

Mosso, G. P. The Bernard-Horner Syndrome. Ann. di Ottal. 1922. v. 50, p. 49.

The author reviews most previous reports on the subject, quoting Horner's description of his original case and the supplementary work of his pupil Nicati. Nicati divides cases according to their symptoms into 1, Prodromal stage, showing all the symptoms of stimulation of the sympathetic on one side. 2, Paralytic stage in which besides miosis, enophthalmos, and ptosis, there is present increased perspiration and increased temperature of the affected side. 3, Second paralytic stage in which, while the eye signs remained, signs of atrophy in the sympathetic were also present, the perspiration being absent and the temperature being lower than normal on the affected side. Examples are given from the literature which show the classic symptoms but which were due to lesions in the optic thalamus and other portions of the brain. The syn-

drome also occurred in epileptics and some congenital defectives.

In diagnosis the instillation of cocain is of value, as it is without effect on the pupil when paralysis of the sympathetic is complete, while it produces an uneven dilatation when there is partial paralysis of the sympathetic. In spasm of the sphincter, on the other hand, it produces an equal dilatation. Adrenalin is also of value, as its instillation produces dilatation of the pupil only when the sympathetic is paralyzed.

The author's first case was a man of twenty-eight who showed typical left sided Bernard-Horner syndrome, except that the tension of both eyes was equal. The relative inequality of the pupil persisted in all conditions of light altho both pupils reacted to light and distance. No cause for paralysis of the sympathetic was evident.

His second case, a man of thirty-two, gave a history of eczema, enlarged cervical glands and phlyctenular conjunctivitis in childhood. He showed left-sided ptosis, miosis, and enophthalmos but no vasomotor disturbances, and his reactions to cocain showed that the paralysis of the sympathetic was not complete. A bibliography of forty-six titles is appended.

S. R. G.

Yudkin, A. M. Ocular Manifestations from Deficiency of Vitamin A. Jour. A. M. A. v. 79 p. 2206, Dec. 30, 1922.

In rats kept on a diet deficient in vitamin, the first sign of an ocular complication is that the eyes water very freely, and the animals seem to dread the light more than a normal individual does. The normally prominent protruding eye of the rat gradually recedes into its bony orbital socket, and the photophobia increases. The animal facies assumes a sleepy appearance. Lacrimation increases and becomes more viscid. At this stage the animal shows signs of ocular irritation and rubs the lids with its front paws. A slight edema of the eyelids becomes manifest, and the viscid lacrimal secretion assumes a sort of serosanguineous character, accumulating in the inner canthi in the form of crusts.

The hair of the lids falls out, and the lids become thicker and may be matted together with a dry secretion. When they are pushed back, accumulations of semisolid, fat like yellowish white patches of secretion, or perhaps exfoliated epithelium in the upper and lower fornices often appear.

In the early stages, the cornea shows no visible changes except for the marked congestion about its junction with the palpebral conjunctiva. There is no visible sclera in the albino eye. With the progress of the eye disturbance and following the swelling of the lids, the cornea shows some signs of haziness, particularly about the periphery. As the patches increase, the normal cornea reflex disappears. Frequently patches are seen on the center of the cornea, but more often extend on to the corneal surface from the fornices. Thereupon the cornea becomes dry, lusterless and oily in appearance, losing its normal transparency.

It was first thought that the central, fatlike plaques were ulcers; but it was found that they could be easily removed from the cornea. To see how much destruction of the cornea is produced when the plaques are removed, fluorescein was instilled. It rolled over this area as water does over an oily surface. Seen thru a corneal loupe, the tissue seemed to be intact; but a slight swelling in the form of a bleb occupied the areas from which plaques had been previously removed. At such times the animal showed marked debility owing to its nutritional decline. Furthermore, if the experiment was continued, the corneal tissue showed frank ulceration, which stained with fluorescein; and, finally, panophthalmitis set in with complete destruction of the eye.

The iris observed in the early stages of the experiment showed very little change; but when the congestion of the conjunctiva was marked, the folds of the iris became prominent thru congestion. Because of the nutritive decline of the animal and the haziness of

the cornea at such stages, further accurate observations on the iris became almost impossible.

On comparison of these ocular manifestations in the albino rat with the somewhat similar clinical condition found sometimes in man, the early lesion resembles that described as xerosis of the conjunctiva and cornea; and the progressive changes of the cornea in the rat are like the condition known as human keratomalacia.

H. V. W.

Neame, Humphrey. Two Cases of Tumor of the Optic Nerve. Brit. J. Ophth., v. 7, 1923, p. 209.

A boy, aged 14 years, was observed with an eye proptosed 18 mm. The increasing prominence had been observed by the mother during the preceding six years. Movement, good; v=shadows.

The external canthus was divided, the eyeball drawn to one side and a mass filling the orbit together with the nerve was removed. Marked swelling of the lids and an ulcer of the cornea followed. This cleared later. Sections of the mass showed a new formation composed of fairly abundantly nucleated tissue with innumberable fibrils forming a kind of a feltwork structure. The nuclei were round or oval and about the size of a red blood corpuscle. The observations made leads the author to believe the case falls into the group of Hudson gliomatosis of the optic nerve.

The second patient was a woman, aged 79 years, with a moderately prominent eyeball. Lens cataractous. Partial exenteration was performed. At the posterior part and around the optic nerve was a hard, irregular mass. Sections showed irregularly shaped mass of cells, which are separated from the neighboring masses by strands of collagen fibrous tissue. Many of the masses of cells are roughly circular, somewhat of a whorl arrangement, with numerous small spaces between the cells. Cell vacuolation and the space formation are the striking features. Diagnosis, endothelioma of the optic nerve, arising from the endothelium of the subdural space.

The author discusses Hudson's classification of optic nerve tumors, gliomatosis, fibromatosis and endothelioma. The contribution is accompanied by six photomicrographs and one illustration. D. F. H.

Walshe, F. M. R. Carcinomatous Meningitis. Exclusively Ocular Symptoms. Brit. J. Ophth. v. 7, No. 3, March, 1923, p. 113.

Secondary microscopic infiltration of the leptomeninges, with signs exclusively ocular is of interest. The lesion was so fine as almost to escape notice on naked eye examination of the brain.

A female, aged 57 years, complained of failure of vision in the left eye, diplopia and headache, loss of weight and difficulty in swallowing. Right eye, visual field, acuity and fundus normal. Left eye, hand movements twelve inches, no defect in the visual field, temporal half of disc pale, total palsy of the external rectus. The pupils were equal; the right reacted normally to light and accommodation; the left to accommodation and consensual illumination, but not direct light. No enlargement of glands or visual lesions or other signs of malignancy were observed.

At autopsy, the brain appeared normal on naked eye examination. On close examination, showed thickening of the left abducens; the pia-arachnoid covering the ventral surface of the pons and surrounding the cranial nerves at their points of emergence from the brain stem were thickened. Microscopic study of these thickened areas showed small scattered groups of infiltrating cells. Where the malignant cells were more abundant, they were arranged in definite groups surrounding a central space like the acini of a secreting gland. The growth was regarded as a secondary deposit from a primary adenocarcinoma, which was not found, but which was probably situated in the alimentary tract.

D. F. H.

Usher, C. H. Metastatic Carcinoma of Choroid and Iris. Brit. J. of Ophth. 1923, v. 7, p. 10.

This is an exhaustive study of three cases. The contribution contains seven microscopic illustrations, and thirty-two references, and a table containing a summary of one hundred and twelve cases found in the literature.

Case A. A male, aged 36 years, believed his vision had been impaired for five or six weeks. General appearance of left eye good. The fundus showed, external to the fovea, the grey, ill defined swelling of +6D. Ten weeks later the eye was excised. The sectioned eye showed a tumor 3.5 mm. thick and 14 mm. in extent in the temporal half. Microscopic sections showed an alveolar growth, areas with columnar epithelial cells and areas of partial degeneration; the optic nerve was not involved. The patient died about five months later. No autopsy being permitted, the primary growth, being latent, it is possible that it may have been in the alimentary tract.

Case B. A female, aged 35 years. The right breast was removed for carcinoma, nine months previous. Both eyes contained metastatic growths. Malignant masses were present on the outer surface of each sclerotic. The choroid of the right eye contained two growths. Both optic nerves were involved. In about one third of the cases both eyes are involved. Death occurred a few months after the onset of eye symptoms. The sectioned eyes confirmed the diagnosis.

Case C. A male, aged 48 years, noticed ten days previous to examination, defective sight in his left eye. A black spot in the eye had been enlarged during the previous twelve months. Three months previous he became hoarse. Six weeks previous he began to lose weight. O. D. V. = 6/6. O. S. = fingers at two feet. A well defined black swelling was observed in the iris below, between the pupillary margin and ciliary region. The pigmented area measured 4 mm. Down and out from the fovea, and along the inferior temporal vessels was a swelling focused at its highest point with a plus 6 D. lens. Three weeks after coming under observation, a similar growth was observed in the lower temporal fundus of the right eye. Axilla, groin and cervical glands indurated. Patient died five months later. Sectioned eye showed carcinoma of the choroid. Tumor pathology was found in the chest. It is of interest to determine whether the iris or choroidal growth was the primary.

From the author's survey of literature, both eyes were affected in one third of the cases, males about one third. Extraocular growths were unusual as the patient generally succumbs before this occurs. Extension into the optic nerve is rare. The commonest age is between forty and forty-nine. The youngest, twenty and the oldest, seventy-two year. Tension, normal in fifty per cent of cases; about forty per cent, increased; ten per cent, diminished. Average duration of life after eye is affected, about eight months. D. F. H.

Sijpkens, T. W. Cylindroma of the Orbit with Carcinomatous Degeneration. Klin. M. f. Augenh. 1922, v. 68, p. 95.

A woman, aged 65, complained for 8 months of failing sight of left eye with increasing pain. There was intense exophthalmus, absolute immobility of the globe, injection of the edematous conjunctiva, and iritis. V. 4/60. Under the eyelids a solid mass was felt along the orbital margin. Exenteration and histologic examination showed that the tumor was a cylindroma, partly transformed into a basal cell carcinoma. This transition speaks for the epithelial character of this tumor. Cylindroma is not very rare, and often it is situated in the orbit. Generally it is considered rather benign, it grows slowly and seldom makes metastases. C. Z.

Filatow, W. Plastics with Round Pedicle. Klin. M. f. Augenh. 1922, v. 68, p. 12.

A band of skin, 5 cm. wide, is dissected from the mastoid process to the clavicle and the ends left intact. The wound is closed by sutures, and the

band converted into a round pedicle by sewing its margins together in the whole length. After 20 days the future lid is prepared by dissecting a flap at the lower end of the pedicle larger than the future defect, and covering its posterior surface with mucous membrane from the lip. The flap is replaced and fixed by sutures to avoid rolling together. After 4 days, under local anesthesia, the lid is removed in its whole thickness and the pediculated flap implanted. The margin of the upper lid was pared, and the flap sewed on this and all along its margin. After a week the pedicle was cut off. It was intended to replace it to its former seat, but the patient did not consent. The microscopic examination of the pedicle showed skin, subcutaneous tissue, fibers of the platysma, abundant arteries and veins. The result was very good. The advantages are: The pedicle completly secures the nutrition of the flap, and excludes infection.

C. Z.

Moore, R. Foster. A Modified Suction Cataract Extractor. Brit. J. Ophth., v. VII, 1923, p. 235.

It consists of two parts, the handle and the cup bearing portion. The handle is connected to Barraquer's vacuum pump by means of thick rubber tubing. It is traversed from end to end by a medium sized bore, which bore communicates with the exterior by the lateral hole; above this hole is a small knob, the idea of which is to act as a guide to the finger or thumb; it is not essential. The cup-bearing portion fits into the handle by an airtight cone junction, and can be placed at any angle relative to the lateral hole. Two cup bearing portions are supplied having cups of different sizes; the curvature of the stem can be altered.

The instrument is used with the right hand for the right eye and the left for the left eye. For ease and delicacy of use it is important that the position of the cup bearing portion relative to the hole in the handle should be carefully adjusted to the position which is most comfortable for the individual operator. Before the instrument is introduced into the eye, the thumb without being shifted is rotated a little outwards so as to uncover the hole, with the result that air is sucked in freely thru this hole and no vacuum is conveyed to the cup. The cup is now introduced into the anterior chamber, and when it is in accurate position on the front of the lens, the thumb is rolled back into position so as to close the hole and the vacuum is now immediately transmitted to the lens; a very slight movement of the thumb is sufficient to effect this closure, or if reversed, the position of the cup bearing portion relative to the hole can be so arranged, that the hole is closed by one or another finger. It will be appreciated that the hole takes the place of the valve in the Barraquer instrument. D. F. H.

Trumpy, Einar. Pemphigus of Conjunctiva. Norsk Magazin f. Laegevidenskaben, vol. 84, p. 27.

Only one case of this disease has been reported previously from Norway. The author's two cases were both males, one 45 and the other 55 years of age. Typical symptoms, objective findings and course of conjunctival pemphigus, are described. In the first case, simultaneously with the appearance of symptoms in the one eye, there appeared an eruption of blebs on the right arm, which spread to the trunk and to both thighs. Four weeks later the second eye became involved. In the second case the patient suffered for two years from recurring pemphigoid eruptions in the nose, pharynx and in the mouth, with gradual improvement. Shortly after the healing of the mouth and throat eruptions, both eyes became inflamed.

D. L. T.

NEWS ITEMS

Personals and items of interest should be sent to Dr. Melville Black, 424 Metropolitan Building, Denver, Colorado. They should be sent in by the 25th of the month. The following gentlemen have consented to supply the news from their respective sections: Dr. Edmond E. Blaauw, Buffalo; Dr. H. Alexander Brown, San Francisco; Dr. V. A. Chapman, Milwaukee; Dr. Robert Fagin, Memphis; Dr. M. Feingold, New Orleans; Dr. Wm. F. Hardy, St. Louis; Dr. Geo. F. Keiper, LaFayette, Indiana; Dr. Geo. H. Kress, Los Angeles; Dr. W. H. Lowell, Boston; Dr. Pacheco Luna, Guatemala City, Central America; Dr. Wm. R. Murray, Minneapolis; Dr. G. Oram Ring, Philadelphia; Dr. Chas. P. Small, Chicago; Dr. John E. Virden, New York City; Dr. John O. McReynolds, Dallas, Texas; Dr. Edward F. Parker, Charleston, S. C.; Dr. Joseph L. McCool, Portland, Oregon; Dr. Richard C. Smith, Superior, Wis.; Dr. J. W. Kimberlin, Kansas City, Mo.; Dr. G. McD. Van Poole, Honolulu; Dr. E. B. Cayce, Nashville, Tenn.; Dr. Gaylord C. Hall, Louisville, Ky.; Dr. Edward D. LeCompte, Salt Lake City.

DEATHS.

Dr. Fritz Schanz, of Dresden, died recently.

Dr. Charles Killick, of Bradford, England, died on April 27, of septicemia.

Dr. Lamme Steele Givens, Cynthiana, Kentucky, age fifty-seven, died May fifth, of cerebral hemorrhage.

Dr. Ira Joseph Magee, Waterloo, Iowa, aged thirty-four, died June first of pneumonia.

Dr. James W. Hadley, Frankport, Indiana, aged forty-nine, died June first of injuries received when he plunged from a seventh story window.

Dr. David Webster, of New York, died May twenty-sixth following a long illness. He was eighty-one years old, and had served a long career as an ophthalmologist in the city of New York. He was a graduate of Dartmouth Medical College, and first began his career as an ophthalmologist as a clinical assistant in ophthalmology and otology in the College of Physicians and Surgeons, New York, and on the staff of the Manhattan Eye and Ear Hospital. He later became a surgeon at the Manhattan and, for about forty years, served in that capacity.

PERSONALS.

Dr. Wilbur F. Swett, formerly clinical instructor in surgery at Leland Stanford University, has been assigned to ophthalmology.

Dr. Harold Leroy Goss announces the opening of offices at 910 Donaldson Building, Minneapolis, Minn.

Dr. Frank Albert Burton announces that he has returned to San Diego and is located at his former offices, Suite 404 Watts Building.

Dr. Hunter McGuire and Mrs. Jane Love Baker announce their marriage on Tuesday, June twelfth, at Asheville, North Carolina.

After September first, Dr. Jules Stein will be associated with Dr. Harry S. Gradle, with office at 22 E. Washington St., Chicago, Illinois.

Dr. P. Obrarrio announces his association with Dr. Louis C. Deane, practice limited to eye, ear, nose and throat, at 350 Post Street, San Francisco.

Dr. Albert Eugene Bulson, Jr., and Miss Memory Edith Breeden announce their marriage on Tuesday, the twenty-ninth of May. They will be at home at Fort Wayne, Indiana, 406 West Berry Street.

Dr. and Mrs. T. W. Ashley, of Kenosha, Wisconsin, sailed June sixteenth for Vienna, where Dr. Ashley will attend a course of study and clinics in his specialty.

On June sixth the George Washington University of Washington, D. C., conferred the degree of Doctor of Science, Honoris Causa, upon Dr. Harry Vanderbilt Würdemann, of Seattle.

Dr. A. S. Fernando of the Philippine General Hospital has been requested by the Director of Health of the Philippine Islands to go to the Culion Leper Colony to make some studies concerning leprosy of the eye.

Prof. Vogt of Zurich will repeat his course in slit lamp microscopy, September third to eighth, 1923. He has eleven complete lamps for use in this course, which will accommodate thirty-three participants. The course will therefore be limited to this number of students.

Dr. George E. deSchweinitz was guest of honor at a banquet given by the ophthalmologists of the Pacific Coast on Monday evening, June twenty-fifth at the Bohemian Club, and the following Thursday evening at the University of Pennsylvania Alumni dinner at the University Club.

Dr. S. Lewis Ziegler, San Francisco, sailed late in June to attend the Oxford Congress of Ophthalmology, following which he will spend considerable time in London and Paris in reference work upon his forthcoming volume on Ophthalmic Surgery. Dr. Ziegler is expected to return about the middle of September.

Dr. Blanche N. Epler, residing at Hatteras, North Carolina, has been appointed by the United States Public Health Service as contract physician to furnish professional services to Coast Guard stations Numbers 181-185 inclusive. She will conduct the visual and other physical examinations of applicants for admission to the Coast Guard service at the stations under her medical supervision.

SOCIETIES.

Dr. Forrest J. Pinkerton of Honolulu has been elected president and Dr. G. McD. Van Poole, treasurer of the Medical Society of Hawaii.

The Colorado Congress of Ophthalmology and Oto-Laryngology will be held in Denver July thirtieth and thirty-first.

The First Annual Dinner-Meeting of the Brooklyn Ophthalmological Society was held at the University Club, 109 Lafayette Avenue, Brooklyn, N. Y., May 17th, 1923. There were forty members present, all Brooklyn Oculists. Dr. Johnathan S. Prout and Dr. Henry R. Price were unanimously elected Honorary Members. The speakers of the evening were Hon. Charles G. F. Wahle and Rev. John L. Belford.

The President gave an interesting resumé of the year's work showing the success of the Society. He called attention to the fact that four members had read papers on original work. He concluded with an appeal that the Society be made more useful not only to the members but to the community at large.

The following officers were unanimously reelected for the coming year; Dr. Joseph E. Golding, president; Dr. Ralph I. Lloyd, vice-president; Dr. Willis M. Gardner, secretary-treasurer; Dr. Henry M. Smith and Dr. John H. Ohly, Members-elect of the Executive Committee.

The meeting was then opened for a round table talk in which the members took particular interest in discussing ways and means of improving the Society.

At the last meeting of the State Medical Association, the Eye, Ear, Nose and Throat men of Charleston, South Carolina, formed a special society to meet at the same time as the State Society. Dr. Charles W. Kollock of Charleston was elected president.

The American Ophthalmological Society for the first time in its history held its annual meeting in the "far West." Colorado Springs and the Broadmoor Hotel made friends with many of the members. A large number of the "old guard" were present, and the meeting was pronounced an unqualified success. The society met June nineteenth to twenty-first under the presidency of Dr. W. E. Wilmer of Washington, D. C., who was especially commended for his familiarity with parliamentary law. Officers elected for the ensuing year were: president, Dr. Alexander Duane, of New York; vice-president, Dr. Cassius D. Wescott, of Chicago; secretary and treasurer, Dr. Thomas B. Holloway, of Philadelphia. The next meeting will be held at Hot Springs, Virginia, the date to be announced later.

MISCELLANEOUS.

The New York Eye and Ear Infirmary is one of several hospitals in New York that is a century old.

The centenary of the Vienna Ophthalmologist, Prof. Karl Stellwag von Carion will shortly be celebrated. He was born early in 1823, and his name is mostly known by his sign in exophthalmic goiter.

Current Literature

These are the titles of papers bearing on ophthalmology. They are given in English, some modified to indicate more clearly their subjects. They are grouped under appropriate heads, and in each group arranged alphabetically, usually by the author's name in **heavy-face type.** The abbreviations mean: (Ill.) illustrated; (Pl.) plates; (Col. Pl.) colored plates. Abst. shows it is an abstract of the original article. (Bibl.) means bibliography and (Dis.) discussion published with a paper. Under repeated titles are given additional references to papers already noticed. To secure early mention, copies of papers or reprints should be sent to American Journal of Ophthalmology, 217 Imperial Building, Denver, Colorado.

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